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Mining Journal

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McGraw-Hill Publishing Company, Inc.

19th Annual Safety Congress and Exposition

September 29 to October 3

Pittsburgh, Pa.

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Phelps Dodge Corporation
Bisbee, Arizona
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U. S. Bureau of Mines
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September 25, 1930

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New York

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McGRAW-HILL PUBLISHING COMPANY, INC., Tenth Ave. at 36th St., New York, N. Y.

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CABLE ADDRESS: "MACHINIST, N. Y."

Published semi-monthly. Price in the United States and possessions, 25 cents (U. S. currency) per copy: $4 per year. In all other countries, $20 per year—24 issues. Entered as second-class matter, June 20, 1879, at the Post Office, New York, N. Y., under the Act of March 3, 1879. Printed in U. S. A.

Member A.B.P. *Member A.B.C.*

7,950 COPIES PRINTED THIS ISSUE

NEW YORK District Office, 285 Madison Ave.
WASHINGTON, National Press Building
CHICAGO, 520 N. Michigan Ave.
PHILADELPHIA, 1600 Arch Street
CLEVELAND, Guardian Building
ST. LOUIS, Bell Telephone Building
SAN FRANCISCO, 883 Mission Street
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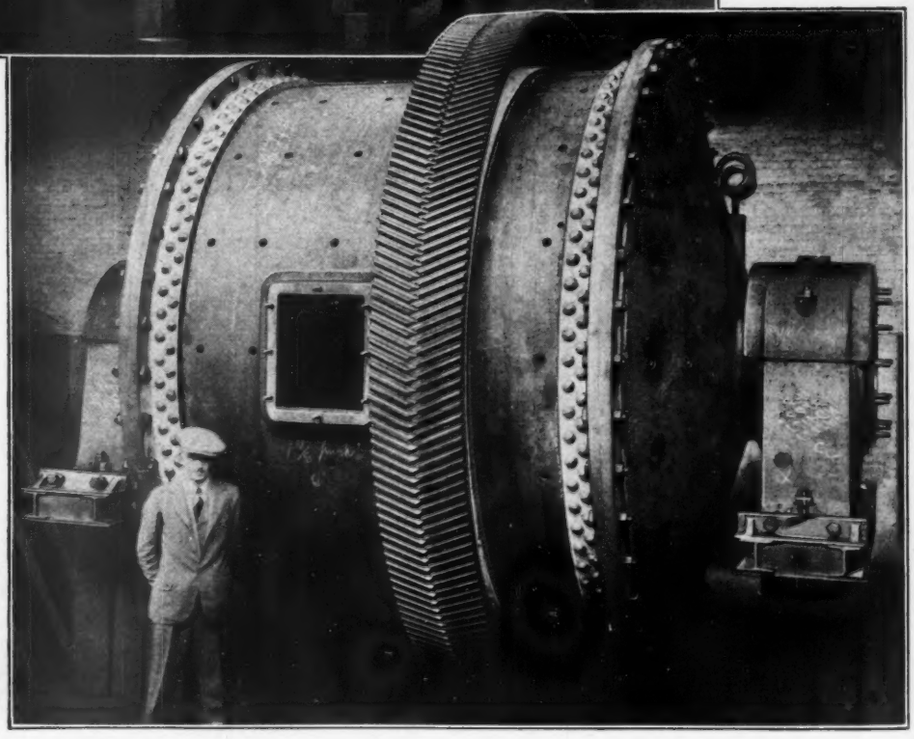

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ENGINEERING AND
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JOURNAL

A. W. ALLEN, *Editor*

VOLUME 130, No. 6

ESTABLISHED 1866

New York, September 25, 1930

Safety First and Constructive Policy

THE safety-first movement, sponsored and promoted so ably by the National Safety Council, has done much to promote the orderly progress of the mining industries. Fear of accident, injury, and incapacity has been lessened, and the general morale of the working force has been raised. Reduction in disability and suffering has been accompanied by the development of a spirit of helpful co-operation. Another link has been forged in the sympathetic relations that are growing between employer and employee. The reasons for safety-first measures are better understood, and the good results are more evident than they were.

The history of mining and metallurgy indicates a gradual evolution from primitive methods, which, in the hands of the engineer, were first modified to insure efficient technical results. His work was later aided and simplified by the manufacturer, who, alone or in co-operation with the engineer, applied inventive ability, manufacturing skill, confidence, and optimism to the task of mechanization of the processes and simplification of the equipment found necessary.

Similar developments are occurring in the field of accident prevention. Companies, convinced by data and statistics that discontinuity of work from any cause spells loss to all concerned, are finding that accident prevention deserves careful and serious attention, and that results can only be secured by the appointment of capable and experienced safety-first directors, possessing tact and skill to enforce salutary regulations without hindrance to smooth operation or consistent output. To aid them in their work comes the manufacturer of safety equipment and protective devices, without which no adequate safety-first program can expect to be successful.

Progress in any branch of endeavor depends on co-operation, especially in the interchange of experience and result. This is the main purpose of the nineteenth annual Safety Congress and Exposition to be held in Pittsburgh, September 29 to October 3. The meeting will provide opportunity to learn what the mining industries are doing to reduce costs and to increase human contentment by the scientific study of the material and psychological factors that contribute to accidents. And an elaborate exhibition of safety-first appliances and aids will provide interest and inspiration to many who fail to realize what progress has been made in recent years in providing means that inspire confidence, prepare for any emergency, and, by anticipating the hazard, prevent its materialization into accident and disaster.

Mining Section

Tuesday Morning

September 30, Fort Pitt Hotel
Lower Level, Norse Room

9:30 **Remarks by General Chairman H. C. Henrie.**
9:40 **Reports of Committees.**
9.55 **Report of Secretary Daniel Harrington.**
10:00 **Safety Responsibility of Management.**
(Fifteen-minute talks.)
T. G. Fear, General Manager, The Consolidation Coal Company, Fairmont, W. Va.
W. H. Comins, Local Manager, St. Louis Smelting & Refining Works, National Lead Company, St. Francois, Mo.
J. B. Warriner, President, Lehigh Coal & Navigation Company, Lansford, Pa.
10:45 **Discussion.**
11:00 **Safety Responsibility of the Foreman, Shift or Face Bosses.**
(Twenty-minute talks.)
A. R. Pollock, General Manager of Mines, Ford Collieries Company, Curtisville, Pa.
W. V. DeCamp, General Manager, United Verde Copper Company, Jerome, Ariz.
11:40 **Discussion.**

Tuesday Luncheon

September 30, Fort Pitt Hotel
Lower Level, Norse Room
12:30 o'clock

All Entertainment—No Speeches.

Tuesday Afternoon

September 30, Fort Pitt Hotel
Lower Level, Norse Room

2:00 **Announcements.**
2:05 **Report of Nominating Committee and Election of Officers.**
2:20 **Fundamental Requirements in Successful Accident Prevention Work.**
P. G. Beckett, Vice-President and General Manager, Phelps Dodge Corporation, Douglas, Ariz.
2:50 **Discussion.**
3:05 **Methods of Educating the Workmen.**
W. D. Brennan, President, Utah Fuel Company, Salt Lake City, Utah.
3:30 **Discussion.**
3:45 **Question Box.**
Discussion led by F. C. Dunbar, General Manager, Mather Collieries Company, Mather, Pa.

Wednesday Morning

October 1

Trip to Experimental Mine and Explosives Testing Station, Bruceton, Pa.

Wednesday Afternoon

October 1, Fort Pitt Hotel
Lower Level, Norse Room

2:00 **Announcements.**

2:10 **Safety Organization for a Small Company.**
D. L. Boyle, Superintendent of Mines, Associated Gas & Electric System, Johnstown, Pa.

2:35 **Safety Organization for a Large Company.**
Carl T. Hayden, General Manager, O'Gara Coal Company, Chicago.

3:00 **Discussion.**

4:00 **Question Box.**
Discussion led by F. C. Dunbar, General Manager, Mather Collieries Company, Mather, Pa.

Thursday Morning

October 2, Fort Pitt Hotel
Lower Level, Norse Room

9:00 **Announcements.**

9:10 **Problems of the State Mine Inspector.**
W. H. Glasgow, Secretary of Mines, Commonwealth of Pennsylvania, Harrisburg, Pa.
R. M. Lambie, Chief, Department of Mines, Charleston, W. Va.
John F. Daniel, Chief, Department of Mines, Lexington, Ky.
W. B. Hillhouse, Chief Mine Inspector, Birmingham, Ala.

10:00 **Discussion.**

10:15 **Protective Clothing in Accident Prevention Work in Mines.**
Clyde Lutton, Safety Director, H. C. Frick Coke Company, Pittsburgh.

10:30 **Discussion.**

10:45 **Safety Practices on the Witwatersrand, in South Africa.**
W. F. Buchanan, Editor, *The Reef*, Johannesburg, Transvaal, South Africa.

11:00 **Discussion.**

11:15 **Question Box.**
Discussion led by F. C. Dunbar, General Manager, Mather Collieries Company, Mather, Pa.

11:45 **Introduction of Incoming General Chairman and His Staff.**

Thursday Luncheon

October 2
1:00 o'clock

At Plant of the Mine Safety Appliances Company

Quarry Section

Wednesday Luncheon and Afternoon

October 1, Fort Pitt Hotel
Joint Meeting with Cement Section

Thursday Morning

October 2, Fort Pitt Hotel
Lower Level, Tudor Room

9:30 **Annual Report by General Chairman A. L. Worthen.**

10:00 **The Value of Co-operative First-Aid Training.**
J. J. Forbes, Supervising Engineer, Safety Division, U. S. Bureau of Mines, Pittsburgh.

10:30 **Discussion.**

10:40 **How We Have Reduced Accidents in the Quarrying Industry.**
Thomas J. Quigley, Chief, Mines and Quarries Section, Pennsylvania Department of Labor and Industry, Harrisburg, Pa.

11:15 **Discussion.**

Thursday Afternoon

October 2, Fort Pitt Hotel
Lower Level, Tudor Room

2:00 **What the National Safety Council Is Doing for the Quarry Section.**
J. V. Scott, Director, Service Extension Division, National Safety Council, Chicago.

2:25 **Discussion.**

2:40 **Election of Officers.**

3:00 **General Round Table Discussion — "Saving Money Through Accident Prevention."**
Led by O. M. Graves, Vice-President and General Manager, General Crushed Stone Company, Easton, Pa.; and William E. Hilliard, General Manager, The New Haven Trap Rock Company, New Haven, Conn.

Sound Leadership and Thoughtful Planning

ALTHOUGH many lines of industry and trade are still showing a slackening of business and curtailed activity, an increasing number of economists and business leaders are expressing the opinion that conditions are fundamentally sound, and that a general recovery is not distant. A year of depressed business, with its usual concomitants —unemployment, pessimism, lack of courage to participate in new enterprises—has tested the economic structure of the nation and found it not wanting. In one respect this period of depression has shown a marked difference from similar episodes that have occurred at regular intervals since the middle of the last century—the beginning of the industrial era. The condition has not been accepted with the same resignation as in the past, but has evoked an awakening realization that these occurrences are not governed by immutable laws or an all-wise providence, that in some way or other means may be found whereby they may be prevented. More and more stress is being laid on mental factors—ignorance and fear—as fundamental causes of the difficulty. This being realized, the logical procedure is to administer the correct antidote—reason, enlightenment, and confidence—to eliminate those imperfections in our social structure that make man a victim of his circumstances rather than the master of them.

Another fact that has been revealed is the international character of present-day commerce. A large section of the world can no longer be depressed by adverse business conditions without serious effect on the remainder. Any effort to evolve a correct solution without taking this fact into consideration must be futile. True benefit to the individual can come only from that which benefits all. A great difference may also be seen in the attitude toward labor. Ruthless cutting of working forces and wages, as formerly practiced, has not been in evidence. Where conditions have made layoffs necessary, an effort has generally been made to protect the needy and to distribute the limited amount of work among as many wage earners as possible.

The lessons may be hard and difficult to learn. Like most lessons they may have to be studied more than once before they become thoroughly understood and digested. The fact that the basic causes have been recognized is, however, an encouraging sign and an important step in the right direction. But the lessons must not be forgotten with the first return of normal conditions. The mining industry has particular need of sound leadership and thoughtful planning for the future, in good times as well as in bad, to minimize undesirable fluctuations in production and consumption with which it always has had to contend, and which until recently have been regarded as beyond control. Constructive thinking rather than negative thinking is needed.

The Delegation and Acceptance of RESPONSIBILITY in Operation and Safety Work

Ralph M. Roosevelt

Vice-President of Eagle-Picher Lead Company

IS INTERVIEWED BY

H. D. KEISER
Assistant Editor

A DISTINGUISHED executive, with a background of successful operating experience, differentiates between those who play the game and those who "just work." The plans of men in charge of operations must not be hampered by too close a control by higher executives, Mr. Roosevelt maintains. In all large companies, as in all industries, certain plants and certain individuals must take the lead. A function of safety endeavor, he says, is to increase the mental alertness of workmen. Monetary reward should be eliminated or put in the background in recognizing zeal in accident prevention work. Efficient subordinates, Mr. Roosevelt avers, are preferably developed from among one's own personnel "by delegating responsibility to them, insisting that they assume it successfully and making room for them to grow." The ability of an executive to do this measures his value to industry.

THE chief executive of a corporation is responsible for the safety record of his organization. He can delegate responsibility but he cannot shift it, and no workman, foreman, or plant superintendent can succeed in his safety campaign unless the chief executive of the company realizes and accepts the responsibility that is his.

A few days after graduation, in passing through the plant where I had gone to work, I noticed a commotion on the loading dock near one of the tank cars used to transport sulphuric acid. In the next few moments I helped haul a man out of the tank and lay him on the loading dock. About two inches of acid mud was in the bottom of the car, and he had fallen face forward in that mud. Evidently he had lain there for some time. I felt his pulse, and it was still beating. A doctor was sent for in a rush, but I knew that if the man were conscious he would not care to live. Soon his pulse ceased. Although this was for the best, I have never quite erased the picture from my memory. However, this is not because I had not seen accidents before.

Some time prior to this, we had been kidding a fellow because he was tamping a charge of dynamite with an iron tamper, telling him not to point the tamper our way. In a few minutes we were digging the gravel out of his hands, wrists, and face. We laughed as we handed him his English helmet with a hole in the front brim where the tamper had gone through.

We also thought it a joke when, in blasting in front of a steam shovel on the face of a cliff, we dropped a large-sized rock through the roof of a cabin in the valley below. This appeared no less funny when we learned that the rock had gone through the roof of the kitchen while the family was sitting in a circle around the cook stove. The rock, however, did no damage other than to leave a hole in the roof and one in the floor, kill a chicken, and knock a leg out from under the kitchen stove. It may have startled the people in the kitchen, but they never mentioned the fact.

Also, little impression was made on us when one day, as we were sitting on the counter of the commissary, a "friend" of the man sitting next to me walked in the door and shot him.

The man doing the tamping did not have to use an iron rod simply because we crimped caps on fuses with our teeth and tossed packages of caps and cans of glycerine to each other in unloading them. The family did not necessarily have to be sitting around in their cabin when they knew we were blasting above them. And the man next to me in the commissary did not have to be so slow on his draw when he knew his friend was looking for him, although had he been quicker something might have happened to the pile of caps and dynamite stored side by side in the same room—and the camp might have had to be rebuilt. But the man whom we hauled out of the tank car was ordered in there to clean it. He had a family, and he had to do as he was instructed. He was forgotten until he failed to appear at lunch time, when his buddy went hunting for him. Everyone said his death was an accident and that "accidents could not be prevented." I could not see it that way, but the foreman in charge knew all about it, and there was no use saying anything to him. If I had gone to the general manager, I would probably have been graduated for the second time within a few days, this time without a diploma. Today we do not clean acid cars during hot weather, when fumes rise from the mud in them. And when a man does enter one, even in the winter, he ties a rope around his waist and his buddy sitting on the dome holds the other end of the rope. I resolved that if I ever became a foreman such things would not happen in my department.

Some time later, in another company, I found myself a foreman, still determined that accidents would not happen in any department of which I was in charge. But they did happen. For instance, in hoisting a car on a pneumatic elevator, the hoist lacked an inch of reaching the elevation of the track on the upper floor. The man pushing cars on the upper floor stepped onto the elevator and succeeded in making the first wheels jump up the missing inch, but

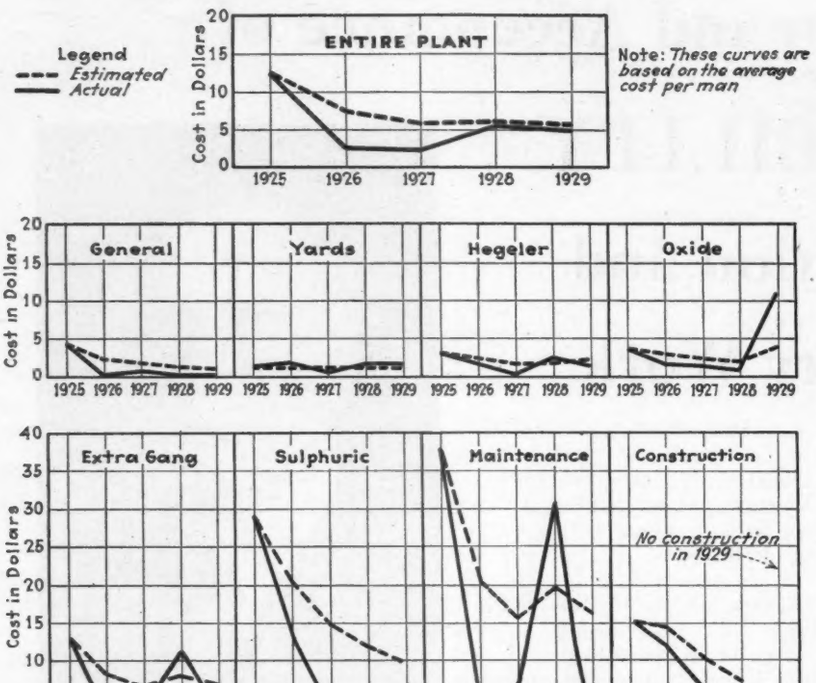

Fig. 1—Five-year accident-cost charts for the Hillsboro plant of the Eagle-Picher Lead Company

in so doing he jarred the elevator sufficiently to make it sag down an inch or two more; this prevented him from moving the rear wheels off the hoist. He called to a man on the floor below to see if the air valve was wide open. The man below pulled the lever the wrong way, and the car of red-hot ore started to tip over. The man on the hoist jumped and sprained his ankle. The man below was burned by the spilling ore and left the hoist in motion. A mechanic's helper ran up to shut off the hoist and had his foot crushed by the falling car. The man who jumped from the elevator and sprained his ankle was under my control; the other two men were not.

A few days later the construction department had a bricklayer working on the top of one of our stacks. He called to a helper below who failed to understand him. So the bricklayer motioned the helper to stick his head inside the stack at the bottom, intending to talk to him through the stack as through a speaking tube. The helper did as signaled. The bricklayer leaned over to speak to him, and, as he did so, upset from the top of the stack several loose bricks that were piled there ready to use. Several weeks afterward the helper's ribs had knitted, and he was able to return to work.

A mechanic, a few days later, came to repair one of our gas producers. Of course, respirators and gas masks were unheard of around a plant in those days. After this fellow had absorbed enough carbon monoxide, we put a wooden wedge between his teeth and sent him to the hospital, where he remained for some time.

With accidents continually happening in our department to men working there under the supervision of other foreman, I found it impossible to prevent accidents to our own men and realized that the foreman of one department cannot prevent accidents in his department unless the safety work is carried on at the same time in all other departments of the plant. I now determined that I would have to wait until I became a superintendent before I would be able to make much progress in preventing accidents. However, the general manager of this company did realize that the company was responsible for the accidents which occurred in its plants and that he had the authority to delegate this responsibility; and he did so—to a liability insurance company. But the insurance company only acknowledged the responsibility delegated to it after being defeated in a court of law. The result was that every man hurt in the employ of that company had to sue the company in order to receive any consideration. These lawsuits were of constant occurrence. Certainly there should be a better way than this of delegating responsibility.

Subsequently I found myself superintendent of a plant. The general manager of this company acknowledged the company's responsibility for accidents and his authority to delegate that responsibility. And he did delegate it—to an insurance company—in exactly the same way the previous company had. Soon accidents occurred, and in each instance the men had to start suit against us to make the insurance company acknowledge its responsibility. I was now a superintendent, but so far had made little headway in preventing accidents. Previously my efforts had been blocked because I did not have authority over the entire plant. This was no longer the case. Something had to be done. Several conferences with the insurance company followed, during which it developed that for every dollar our company paid to the insurance company the men received 19c. in compensation. Approximately 20c. was required for operating expenses and 40c. for legal costs, which left 21c. as profit for the insurance company. I thought that, if the insurance company would allow me to settle the compensation in each case of injury to my men instead of having the injured man sue, I might be able to save the insurance company the 40 per cent which it was spending for court costs, giving half of the saving to the men and adding the other half to the profits of the insurance company. They were willing to try this plan. The matter was explained to the men and from that time no man in the plant ever sued the company or cost the insurance company a cent for legal assistance or court costs. The amount we paid to the injured men was doubled, as also were the profits of the insurance company. But even with this arrangement, the men were receiving less than 40c. on each dollar we paid for insurance, and I figured that the insurance company was making 40 per cent profit on our account.

I wished the men might receive 100 per cent of the amount we paid for compensation, but this could not be done unless we carried our own insurance. I felt that if the men knew we carried our own insurance, and that the cost of every accident was paid by us instead of by the insurance company, our progress in accident prevention would be speeded up considerably. But the general manager or the president of a company is the only one who has authority to make such a change in the policies of a company, and at that time our general manager was not convinced of the probable success of such a change. So once more my plans were blocked, but I resolved that if I ever became manager of a company we would carry our own insurance. I believed we would then be able to succeed in our accident prevention work.

Later I built and became manager of

what is now the Hillsboro, Ill., plant of the Eagle-Picher Lead Company. There, the responsibility was all mine. We started by carrying our own insurance. The best insurance rate offered us was more than 1.8 per cent of the payroll. To begin with, we set aside 1 per cent of the payroll. The charts in Fig. 1 will show you what the costs of accidents in that plant are today. The record of that plant is 558 days without a single lost-time accident, and that has remained the record for the entire company until recently. Hillsboro has just won the silver trophy given by our president for the plant or mine in our company having the lowest accident record per man-days for the last six months. It has, by its good showing, not only brought happiness to its employees and their families but also has set an example for many other organizations in the vicinity, the results of which are far reaching.

The personal experiences cited have proved to me that no matter how hard the workmen, foreman, or superintendent try to prevent accidents, they will not be successful unless they have the active support of the executive head of the company. The Hillsboro record, made with such support, has also proved to me that *if a company or plant is making a poor safety record the responsibility for it rests absolutely on the shoulders of its chief executive.*

All of us have heard it said that an executive situated in a large city cannot be responsible for accidents which happen in plants a thousand miles distant. The executive selects a subordinate to operate that distant plant. He acknowledges his responsibility for that subordinate and the results obtained. Certainly he should do the same in regard to the subordinate he selects and to whom he delegates the safety work. The executive knows from the safety charts of other companies what results he has a right to expect from his own safety department. He knows from his own safety charts whether or not he is obtaining the results he has a right to reasonably expect. He has placed the subordinate in charge of this work. If the subordinate has the executive's active support and still does not obtain the results, the executive has the authority, and it is his duty, to replace him.

When an executive is at a distance from his plant, his task is really easier than if he were at the plant. When he is at the plant, he is like an investor who sits watching the ticker—he is so close it is difficult for him to maintain the proper perspective. And, when the man in charge of safety explains in such a convincing way how an accident happened, the executive agrees "it could not have been prevented." It is the same when an operating superintendent can make contact with the executive and explain that the fall in output the previous night was due to the low voltage furnished by the power company, and can prove it by his voltage charts. The executive immediately is drawn into the controversy and excuses the record. But when situated at a distance, he only knows that the plant operated successfully and without an accident or that it did not. That is all that is necessary for him to know.

The president of one of the largest corporations in the United States said recently, referring to a certain phase of his duties, that he did not want to know details. He found it much better not to know them, because by knowing them he was morally placed in the position of an accessory. If unacquainted with the details, he could not divide responsibility with the man to whom he had delegated it, and for an executive to divide responsibility with his subordinate, after he has delegated it, is as fatal as not to delegate it at all. In fact such division of responsibility is as bad as when his board of directors allows him to finesse it into directing his executive actions. In such instances the board cannot criticize its executive, and the executive cannot criticize his subordinate. Procedure of this character, whether it applies to operating or safety work, will ultimately result in failure.

After the acknowledgment of responsibility and its delegation and acceptance have been recognized, one must realize that the best organization possible will eventually fail if it does not take into account human nature. No one likes to work—nearly everyone likes to play. If doing one's task is work to an individual, he will not succeed at it. If it is play to him, he should succeed. Stenographers, for instance, may be divided into two types. One type cannot tell you what was in a letter fifteen minutes after it has been written. The other type, three months after writing a letter, can tell you what it contained. All those who cannot recall what they have written we let go; the others we keep. The girl who cannot remember is merely working. The girl who can remember is playing—to her the work is a game and she enjoys it.

When I was out West not long ago, I bought a polo pony for $50, a good riding horse for which someone had paid $400 six weeks previously. He was sold to me for $50 because he would not play polo. Polo was work to that horse. In him I had a good horse as long as I assumed responsibility for wherever he went. But a polo pony must assume his own responsibility, enjoy the game, and follow the ball with little guidance. The relative efficiency of a man who is playing the game and that of a man who is just working are in about the same ratio as the prices of the playing and non-playing polo ponies. That is about eight to one. To succeed, an executive must first choose men who like to play the game, and then see to it that they have an opportunity to succeed by arranging the game for them to play.

Competition enters into every game, and it should be fostered. In our company many methods are employed to arouse competition in connection with safety work. For instance, from the sign at the gate of our plant in Hillsboro, Ill. (see Fig. 2), you will surmise that at least some of our men at that plant "go to the dogs"—or attend the dog races. The hare shown represented the best record of our Hillsboro plant and of the company as well—558 days without a lost-time accident. The first of the two hounds chasing the hare represented our Hammar plant at East St. Louis, which had operated 349 days without a lost-time accident at the time the photograph was taken. Following

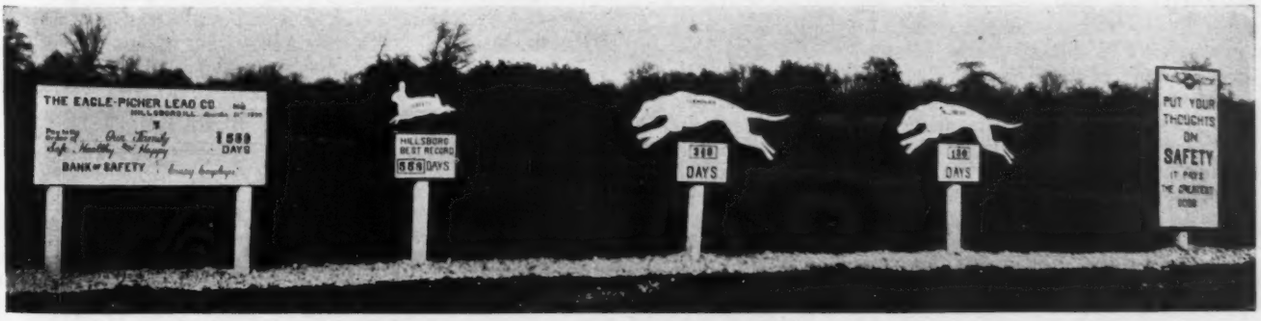

Fig. 2—The "Safety Race" at the entrance gate of the Hillsboro plant

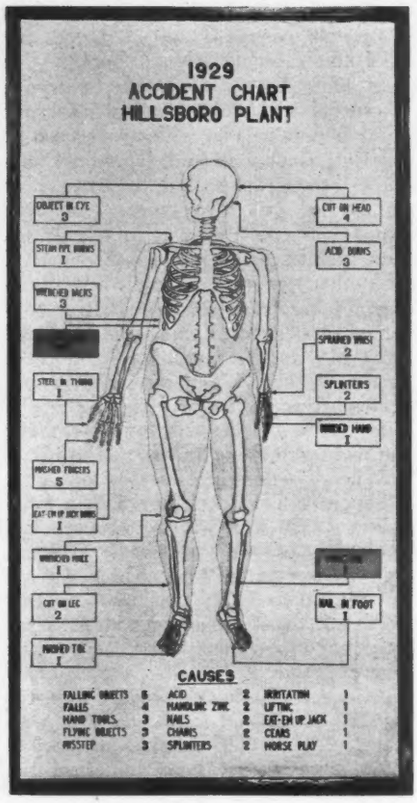

Fig. 3—Employees are educated in safety with the aid of charts. This one shows the causes of 1929 accidents; the shaded blocks represent lost-time accidents.

the Hammar hound is a hound representing our Hillsboro plant, which had operated 150 days toward a new record without a lost-time accident. The sign ahead of the rabbit shows a check for 559 safe, healthy, and happy days—one day more than the previous record—payable to "Our Family" on the "Bank of Safety" and signed by "Every Employee." Since this picture was taken, the Hammar hound has captured the rabbit representing Hillsboro's previous record of 558 days, and today (Sept. 5) our Hammar plant has operated 652 days, and our Hillsboro plant 452 days, without a single lost-time accident.

In opening up a new country some group must be the pioneers. In starting a new industry some group or company must do the pioneering, and in starting safety work in a corporation some plant must take the lead. To the plant that does this, and by example causes the other plants to follow, should belong a great amount of the credit for the entire safety campaign. In our company the Hillsboro, Ill., plant was the pioneer in our safety work, and to it belongs the credit due a pioneer. Today, however, it is being hard pushed by most of our other plants and mines. The Hammar plant has just recently broken the company record long held by Hillsboro. When the silver cup, given by our president to the plant or mine having the lowest lost-time-accident rate per man-day, was presented for the first six months of this year, four plants and mines had not even one lost-time accident during the entire six months. Hillsboro won the cup, but only because it had the most man-days of the four plants and mines having perfect scores.

When competition in any game is as keen as it is in the safety competition of this company, the record of the standing of the different plants and mines becomes particularly important. Of course, each plant and mine has its own scoreboard, but the score, as far as the chief executive is concerned, is kept on the two forms indicated in Fig. 1 and the accompanying table of detailed statistics for the first quarter of 1930. The chief executive is responsible for the appointment of the scorer, and he watches the competition from a distance by means of these forms and not by personal contact with the individual plant or mine.

In the safety game the men, all of whom comprise the several teams at each mine and plant, have to be trained as in football or any other game. They are examined regularly by a physician and prescribed for or advised, and, if necessary, sent to a dentist in order that they may remain fit physically and keen mentally. Then the hazards they have to face are impressed on them. The chart shown in Fig. 3 is used at our Hillsboro plant and clearly indicates to the men where on the body most accidents occur in that particular plant. The workman has to guard against the type of accidents shown on this chart just as the shipmaster has to lay his course to clear the reefs shown on his chart. For instance, one of the principal types of accident is "object in eye." The workman should be impressed with the fact that he must make a special effort to protect his eyes. "Bruised hand" is another—he must watch his hands carefully—and so on.

Undoubtedly the more extensive use of machinery is increasing the mental alertness of the American workman. But this machinery also provides cause for more accidents. If mental alertness increases in direct proportion to the increase in the use of machinery, the accident rate continues unchanged. The rate drops only when the increase in mental alertness exceeds the rate of increase in the use of machinery. To increase the workman's mental alertness is one of the results our safety men have to accomplish.

Naturally, in all competitions the winners expect some reward. They get it generously, but not in money. Large cash bonuses for safety achievement are detrimental. When such rewards are granted, the men are striving for money rather than for their own preservation. At one of our plants the prize for the man making the best safety suggestion for the year is $10. It is given to him at the Christmas party of the men, and it is the praise he receives and not the money that is important. To the plant or mine making the best safety record for each six months' period goes the

Eagle-Picher Lead Company's Safety Record for the First Quarter of 1930

(Small figures are for the year 1929.)

Plants	Jan.	Feb.	Mar.	Total Number of Accidents to Date This Year	Accident per 1,000 Man-shifts	Longest Period of Time without Accidents, Days	Rank
Joplin	7 3	4 2	4 3	8	0.92 0.30	25	14
Cincinnati	0 1	1 1	1 1	3	0.18 0.23	91	12
Galena	0 0	2 0	1 0	0	0.49 0	111	2
Ontario	1 1	1 1	0 2	4	0.95 0.89	86	17
Henryetta	1 1	1 1	0 0	2	0.23 0.11	70	10
Hammar	0 0	0 0	0 0	0	0 0	494	3
East St. Louis Oxide	1 0	0 0	0 0	0	0.18 0	193	9
Hillsboro	0 0	1 0	0 0	0	0.06 0	308	1
Newark	0 0	1 0	0 0	0	0.15 0	346	7
Argo	0 0	0 0	1 0	0	0.10 0	299	4
Montana (Arizona)	2 7	0 2	1 1	10	0.89 0.46	51	15
Crawfish	0	0	0		0.68	120	
Netta	1 0	1 0	1 0	0	0.30 0	99	5
Goodwin	0 2	0 2	0 1	5	0.08 0.74	267	16
Swift	0	0	2		0.47	101	
Bendelari	3 0	3 0	1 0	0	0.66 0	132	6
Big John	0 0	1 1	0 0	1	0.88 0.22	130	11
Crutchfield	1 0	0 0	0 1	1	0.48 0.27	142	13
Picher	1 0	0 0	0 0	0	0.06 0	440	8
Total	18 15	16 10	12 9	34	0.38 Av. 0.22		

Accident Rate per 1,000 Man-shifts

1927	0.63	Jan., 1930	0.29
1928	0.47	Feb.	0.24
1929	0.38	**1st Quarter**	**0.22**

president's cup. Here again, it is not the value of the cup but the prestige that goes with its capture that counts.

Only to the men in charge of the safety work, whose salaries are set in accordance with the results they obtain, must the rewards be monetary. In our mining, manufacturing, sales, and all other departments we chart the statistics of that department, both past and future. We plot the future because past statistics make a pretty picture but nothing more, unless they assist in predicting the future. However, considerable of an executive's time is often saved if his subordinates plot the future statistics of their respective departments at least two months in advance, instead of making rosy predictions and counting on the executive to forget the predictions by the time the results are recorded. So in the safety department we plot the future, as indicated in the accident cost chart of the Hillsboro plant shown in Fig. 1. Predictions of the future are indicated by dotted lines, actual records being shown in solid lines. As is evident, the plant as a whole did better than was anticipated.

This method of plotting the future not only makes a safety man prophecy what record he is going to make but also forces him to make good in accordance with his own figures. Thus, in plotting the future performance of his department, he unofficially sets his own salary. All the executive has to do is to check the actual statistical curve to see if the department head has earned the salary he set for himself. Of course, no department head would care to anticipate decreasing efficiency in his department, and if his prediction curve is a horizontal line he can scarcely solicit a salary increase.

Where to get the efficient subordinates an executive requires is a problem, but in most instances it is preferable to develop them from among one's own personnel by delegating responsibility to them, insisting that they assume it successfully, and making room for them to grow. The ability of an executive to do this measures his value to industry.

Practical Management

E. J. Ristedt

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Oroya, Peru

THE last two decades have witnessed wonderful developments in the progress of industry. Standardization, open interchange of ideas, time studies—each has had a part in this advance. Scientific management—for that is what these phases have been termed—has been preached and practiced, and many companies have tested and adapted developed ideas in order to better results.

Sometimes a new idea suffers not because it is impracticable but because some minor detail or local condition has interfered, militating against its expected success. About ten years ago a committee was commissioned to study the subject of waste in industry. This committee, headed by Mr. Hoover, was composed of representatives from the engineering societies of the country. Their report is worthy of consideration here. After thoroughly investigating many unrelated industries, the conclusions showed that management was responsible for more than four times as much waste as either labor or outside contacts. In making these analyses, the investigators viewed the subject of waste in industry from the following aspects: (1) Low production, caused by faulty management of materials, plant equipment, and men; (2) Interrupted production, caused by idle men, idle materials, plants, and equipment; (3) Restricted production, intentionally caused by owners, management, or labor; (4) Lost production, caused by ill health, physical defects, and industrial accidents.

Management is defined as the art or science of preparing, organizing, and directing human effort. Inasmuch as management has the greatest opportunity for accomplishing success in industry, it must also accept responsibility in like proportion for eliminating the waste therein. Responsibility is measured by the opportunities people have had of knowing better or worse, not by what is done.

The committee mentioned recognized four major responsibilities involved, on the part of (1) management; (2) labor; (3) the owners; (4) the public; and it was upon this basis that the relative responsibilities among the agencies of management, labor, and outside contact were determined.

In discussing management with reference to metal mining, the first question is one of organization. The usual organization chart (see Fig. 1) shows the general manager in the superior position, with each department head tributary thereto, but all such officials on a par with one another. After weighing the relative working conditions under which these departments operate, and taking into consideration the greater difficulty in obtaining as close supervision in the mine as well as in other phases of the work—such as greater labor and material requirements, diversity of operations, and hazards—it seems logical to give the mine some preference. A chart showing this is reproduced in Fig. 2.

From the standpoint of human effort, the success of a mining operation depends upon the maximum average tonnage obtainable for the amount of capital invested and expended in delivering ore ready for treatment. Except for comparatively small amounts obtained in development work, this ore comes from the stopes or pits as the result of the miners' labors. The stope miner, then, is the key man in accomplishing the prime function of a mine. His efforts to carry on his work depend on several items, both of a direct and an indirect

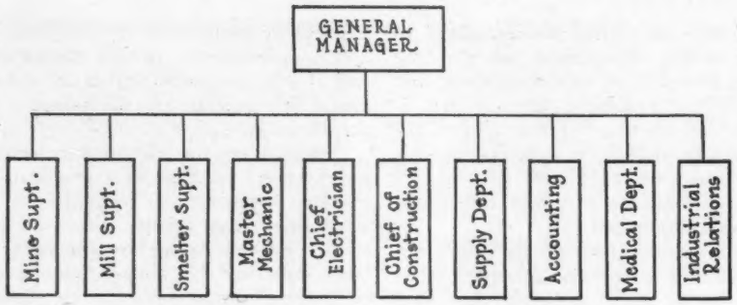

Fig. 1—Typical organization chart

nature, all of which influence his efficiency, as shown in Fig. 3.

To view the situation from the standpoint of the miner will be to establish a substantial basis for the future development of the enterprise, a sort of solid foundation that will contribute a large share in supporting the superstructure of the organization and in earning a profit for the investors. This principle of keeping the basic producers on actual production all the time is generally recognized in all industries. For example, in shop work, routing clerks or "secretaries to the machines," as they are sometimes termed by the workmen, are employed to keep equipment working at a maximum.

In commenting on the direct factors affecting the miner, some phases of the work are stressed because the opportunity for improvement seems greater than in other equally important phases. For instance:

1 The method of mining will depend chiefly on several natural characteristics of the ore occurrence, such as: (1) character of the walls or country rock; (2) character of the vein matter or orebody; (3) value, width, and pitch of ore deposit.

However, few deposits are limited to only one method of working. In selecting a method, consideration should be given to the manner in which the miner will be required to do his work. Any method that involves more than ordinary personal risk or hazard in routine will reduce the miner's capacity for production. If obliged to scale rickety scaffolds, or to balance himself on the steep side of some underhand stope, he does so at the expense of the normal amount of work he could otherwise perform. It is one task to develop a good miner, but an entirely different proposition to crossbreed his education to produce an equally efficient one with the sure-footed instinct of a quadruped.

A method permitting continuous ore production is a decided advantage. Many miners in stopes that require distinct periods for filling with waste, after one of ore breaking, seem to lose interest during the waste-filling period. If the method selected requires a timbered chute, the little economy made on timber saved by using a small-sized chute is more than offset by the greater wear and tear on that timber, the difficulty in preventing choking, and the smaller storage space than will be available in a larger chute.

2 Foremen and shift bosses are chosen for their superior knowledge of mining operations and their ability to direct men in that work. Shift bosses are a necessity, and any company that expects a shift boss to accomplish good results will not burden him with the supervision of too much territory. The boss who can make his run in the morning or during the forepart of his shift is free to devote a little time in a place with bad ground, to make a second trip to places that are backward, or to see what is going on in the less frequented places. It is the duty of a boss to direct the efforts of his men, to issue the necessary orders for supplies needed, but not to hunt up or obtain such necessaries except in case of special emergency. A shift boss should use foresight to anticipate and order supplies in sufficient time to permit their delivery to his run. After the order is placed it is the function of other officials to see that delivery is made to the proper place. There used to be a saying in Western mining camps that little mining knowledge was required to boss men in some of the less-advanced foreign countries, but it seems much better logic to maintain that foremen and shift bosses with excellent training and ability are needed to offset the disadvantages under which under-privileged men are obliged to work.

None other than a workman's direct boss ought to have the right to discharge him. Some safety engineers have felt that a pad of discharge blanks was a necessary part of their equipment, to be issued as they saw fit without consulting the man's boss. It is human nature for any boss to feel resentful when an outsider interferes with his men, and such resentment will more than offset the safety engineer's efforts or his good intentions. If the safety program does not have the active co-operation of every official on the job, it is almost useless to teach or to drive the workmen to observe such regulations.

3 Attention to conditions under which men are required to work in a stope is of comparatively recent origin. The condition of the entrances, the ease and safety with which tools and materials can be transported into these places, the humidity and circulation of the air, and the drainage—these are matters that need constant attention and correction. The advantages of well-designed manways with good ladders are so obvious that comment is hardly necessary. It is surprising, though, how often water is allowed to find its own way from an upper level, through working stopes, to the level below. Ventilation warrants considerable study, much more in the early stages of a mine's development than has been accorded to it in the past. Stopes are the hardest of all of the working places to condition. Available airways from levels to stopes are usually

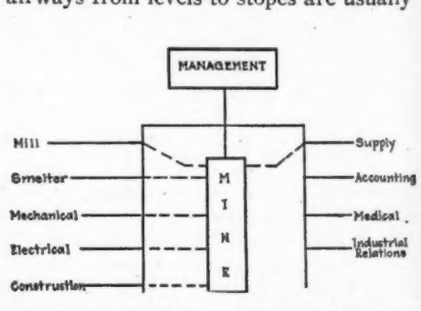

Fig. 2—Organization chart showing the mining department as the central department of the organization. Solid lines indicate channels of direct responsibility; broken lines, those of co-operative responsibility.

limited in cross-sectional area, varying from 6 to 12 sq.ft. Frequently the larger-sized ways are equipped with platforms and inclined ladders, which offer excessive resistance to air passage. If all the connections to a stope emanate from the same level, one can expect very little natural circulation therein. Air cannot be seen coursing by or splitting off from the main current, but this offers no reason for considering it as a mystery. It invariably follows the line of least resistance, short-circuiting wherever there is an easier route, like water in ditches.

The limitations of auxiliary fans are seldom appreciated. To relate an instance: A small size of an excellent type of fan was purchased to cool one stope. The rated capacity of this fan was less than 1,000 cu.ft. per minute; a short line of 8-in. pipe conducted the output into the stope, which normally was more than 10x10 ft. in cross-section. By the use of this fan the average velocity through this stope was con-

siderably less than 10 ft. per minute—a negligible amount to effect any cooling due to evaporation. In addition, the difference in temperature between the air on the level where the fan was located and that in the stope was less than 5 deg. F. The result, of course, was unsatisfactory, but that was not the fault of the fan.

The greatest dissipation of air currents comes from allowing discarded manways and chutes in worked-out stopes and abandoned sections of the mine to remain unsealed. Decaying timber and oxidizing waste absorb appreciable amounts of oxygen, and if air from such places finds its way back to the main air current, the effect on the efficiency and the health of the workmen is very noticeable.

4 A problem that demands real study is the one of maintaining an adequate working stock of tools at the underground distributing points, to keep the workmen going at all times, yet without tying up too much capital in these items. Keeping up a supply of drill steel usually offers the greatest difficulty. This may be caused by a penurious attitude on the part of the company, either in allowing too little for the machines in operation or because an inferior quality is purchased, thereby requiring more frequent changes, or to extravagance on the part of the workman. If men are permitted to use drill steel for any purpose other than drilling—as, for example, for staging on which to work, for chute bars, or pipe hangers—the fault lies with supervision. Disciplinary measures should be taken to correct the practice. Hoses and spare machines, subject always to hard usage and too frequently to rough handling, deserve their full share of attention when considering the question of mine requirements.

More experiments in improved mining practices or innovations have failed or shown only mediocre results because

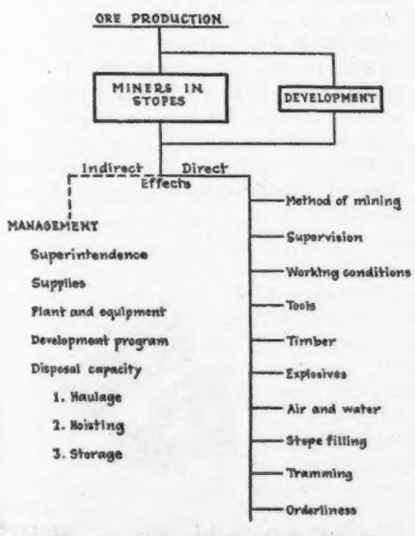

Fig. 3—Factors affecting miners' production

of an insufficient supply of drill steel than form any other cause. When such experiments are attempted, a realization of the increased amounts of tools and timber necessary, because of the greater speed with which the work is accomplished, is not fully appreciated.

After the Cia. de Minera de Peñoles completed its notable achievement in driving the tunnel at Ojuela, Mexico—as described in *Engineering and Mining Journal*, July 14, 1928—many companies utilized the complete information made available regarding the operating program. But how many of those companies have equaled the Peñoles record? Decided improvements were accomplished in some instances; others had no occasion for tunnel work of that nature, but some of the men from that original crew who went elsewhere were unable to achieve the expected results, because the basic conditions necessary were lacking in one or more respects.

5 Lack of timber convenient to the working place causes the next most important loss in men's time. It is serious enough to lack timber in one's yards, but another matter to have it on top ready for use but not down where it is needed. The loss involved by having a reasonable amount of standard sizes of timber cut ahead of actual requirements never has nor ever will equal the loss in production caused by men waiting for timber or preparing timber to use in the mine. Even the meanest of the timber items, the wedge, may be the rarest in the workings. Definite places should be allotted for storing timber, and extreme care taken that certain classes are segregated.

6 Of the usual run of supplies needed by the miner, the distribution of explosives offers less of a problem than any other item, probably because there is no subterfuge that can be resorted to in lieu of blasting materials. Dull steel can be run down again, or temporary props set in place of regular sets, but for powder there is no substitute.

7 Compressed air and water are the meat and drink of the drilling machines, with the meat as the vital factor. Dry drilling has been in vogue for years, but its injurious effect on the miners has resulted in the enactment of laws in some countries and states prohibiting the use of dry machines. Wet drilling is more efficient, so that a mutual benefit really results. A recording gage with chart indicating the air pressure in the system each day is one of the most important gages that can be installed. When the pressure in the mine is permitted to drop under 60 lb. at peak drilling periods, it is like cutting a hole in the bottom of the company's purse.

Potable water in the mine is more important than past practice seems to indicate. Men are usually working in the development faces under the most trying conditions, and these men must have drinking water. In a hot humid place a man's efforts decrease as his discomfort increases, and if water is not easily available, he feels justified in seeking it.

8 When mining methods requiring filling are used, that factor, of prime importance, usually represents a distinct problem in being able to supply sufficient quantities to keep the stopes well caught up and capable of producing the required tonnage. Some ground will stand without filling, but such a place is always a menace to any near-by workmen, making difficult the effective control of any ventilation system in a mine. To use such a place for waste disposal is to free a corresponding capacity in cars, hoists, and bins in many instances.

9 The subject of tramming seems simple enough, and is probably the least technical of the various phases of mining. Nevertheless, more than one good ore-breaking cost has been nullified by poor tramming conditions. Not long ago the technical press reported an instance of a mine that had gone bankrupt, which had operated for several years without return to its owners. The interests which acquired the property at the foreclosure sale enlarged the haulageways, installed electric haulage, and replaced the old one-ton cars by new four-ton cars. Operations thereafter were profitable.

Prior to the adoption of a tramming system, due consideration should be given to: (a) installing and maintaining a good roadway; (b) acquiring serviceable rolling stock best adapted for the purpose; (c) provision of an easy and convenient arrangement for loading cars, with proper provision for taking care of spillage; likewise an easy and rapid dumping scheme; (d) seeing that tramming offers a minimum of interference to other normal operations that must be carried on simultaneously.

A good roadway means all that it implies: a well-ballasted roadbed as dry as is possible to maintain, regular grade, rails of sufficient weight for the required duty, good frogs and switch points, guard rails that are effective; and, last but most often neglected, a suitable switch throw. To require or allow men to throw switches by reaching in between car wheels with their hands, or kicking them over with their feet, borders on criminal neglect on the part of the company. A good roadbed also means keeping it clean as well as dry,

and no one has ever accomplished this or got maximum tramming results when the only allowance left for draining the level was in the space between the rails.

The usual difficulty encountered with reference to rolling stock is the lack of it. Chute loaders cannot keep busy if empty cars are available only part of the time. Before selecting a standard type of car, consideration should be given to factors other than capacity and sturdiness, such as ease of dumping, type of bearings, and kind of couplings. Some couplings, when the motor is pushing a train, cramp the wheels against the track, creating excessive friction between the rails and the diagonal wheels. Such wear is very injurious to switch points, frogs, and wheel flanges, increasing breakages as well as multiplying the dangers from derailments. One derailment frequently means that the train loses a trip for that shift. This cramping likewise causes a power consumption that is several times the normal, with the attendant danger of burning out the motor.

Easy loading conditions depend mainly upon the design of the chute. A door or doors sufficiently large to pass all ordinary sizes, an ample throat in the chute to minimize the tendency to choke, and, frequently lost sight of, the slope or inclination of the chute flooring—these are features that merit regard. When a stream of ore from a chute hits the far side of the car in the upper half of its height two disadvantages result: even distribution of the loading is impossible without using a shovel; and, in the loader's effort to fill the car, spillage is excessive.

Where standard cars and chutes are used, a material aid can be accomplished by allowing a horizontal clearance between the near rail and the chute posts, and by so fixing these posts that the line of maximum ore stream will hit the car side at about the lower third of its height. This, in addition to showing the exact inclination of the flooring, gives the timbermen his needed instruction for the desired results. Easy loading conditions include a good platform from which the loaders can work naturally; and, also, proper tools with which to do the work.

When the haulage system is being planned, sufficient consideration is rarely given to the interference the trains will offer to other legitimate operations. Ore and waste pockets, of necessity, must be close to the shafts, and hauling must be carried on between the various pockets, but that is no reason why traffic to or from the shaft station must be cut off every time a train comes to the pocket. Except on long hauls, and disregarding outside interference, the time required to load a train of cars from a good chute is about half the time consumed in making a complete round trip. If a train blocks all other traffic at that point, these other phases of the work suffer to that full extent. On hauls of any length, double-track sections or spurs should be included as part of the system, to permit trains and trucks to pass without much backtracking.

10 Orderliness may be an uncommon term to apply to mining operations, but it is none the less applicable. A miner going from place to place in search of a needed requirement is not accomplishing his mission. When all ordinary supplies, especially timber, are stored in definite places, the men need look in those places only. The boss in checking up his level stocks has his efforts simplified. To permit timber to be piled along the sides of drifts through which traffic must pass shows an utter disregard for the safety of the workmen and a slovenly way of storing. Altogether too much time is wasted by miners in quest of material essential to their work. If more time were devoted to remedying distribution, less would be needed for "pounding men on the back." Keeping men at top speed all the time sometimes means that they are making up for a deficiency that exists higher up.

There is a great opportunity for improving the distribution of supplies to men at working places; much of this could be done on the afternoon and graveyard shifts by men for that purpose alone. Having a storage place near the entrance of each stope, even if necessary to shoot out some ground for it, would prove economical. Why compel a man, capable of earning $8 to $10 a day under contract or on bonus work, to spent a part of his shift outside of his stope, thereby halting that production in part or even completely during his enforced absence, when another man receiving only a part of that pay could supply the wants of several near-by places in making that same trip?

The indirect causes that effect miners' production can be summed up briefly in one word—management—because these individual causes are the direct functions or policies of the management. The manager is responsible for the competency of his superintendents and department heads, for the extent to which the supply department maintains stocks of required articles, for the design and capacity of the plant and equipment, for the development program in the mine and the disposal capacity for handling the mine's products. This disposal capacity includes the amount that can be hauled per shift, both in the mine and on surface; the amount that can be hoisted; and the storage in the mill and various mine bins.

A manager's initial effort is directed toward organizing a staff that will accomplish the task most economically. The manager who can achieve this through the willing co-operation of his assistants has a much greater reserve power within his organization than the manager who must exert a driving force on the men. The latter type of manager is at times compelled to such actions because of a lack of foresight or faulty judgment in the past, which shoulders the organization with a permanent handicap. To err is human, but to sense that error and to alleviate the faulty condition denotes keen insight. To possess keen insight is to be able to translate conditions as actually seen into terms of betterment for that task. For instance, if men are observed idling about some particular place more or less consistently, perhaps they are not to blame. Some feature there requires a change of practice, or existing facilities are insufficient. A trainman may drop off the train regularly to watch his cars pass over some switch, which could easily be repaired, thereby speeding the hauling.

As has been said before, the greatest waste in mine operation is that of men's time. Little is needed to make it an appreciable portion of the shift. In districts where the eight hours is figured "from collar to collar," a man's actual working time will average less than six hours, so an hour lost from production represents about a 20 per cent loss.

A prominent mining executive, after a visit to the Ford Motor plant, remarked that Henry Ford was the only man who could get eight hours' work from his men in an eight-hour shift. After analyzing his observation he realized that every man on production or assembly had all parts and supplies delivered to him at his working place. That man did not have to climb several flights of stairs, go to a stockroom somewhere distant and wait his turn to get what he lacked. It was there where he needed it, and when he needed it.

Too many mines in the past have been conceived after the manner of Topsy of "Uncle Tom's Cabin." When questioned as to her birth, she insisted, "Never was born—I 'spect I just grow'd."

First Aid to the Injured

W. J. McConnell

Industrial Health Service, Metropolitan Life Insurance Company, New York, N. Y.

THE watchword in emergency service, as in every walk of life, is preparedness. Not infrequently, the life of an injured person depends on what happens to him from the time of the injury to the arrival of the physician.

The principles involved in first aid to the injured are so simple and so easy to master that every man and woman, boy and girl, can with a little training effectively administer first-aid measures. In the more isolated places, such as mining communities and in the mines themselves, first-aid training is more important than in large cities, where a physician is readily located.

Provision for first aid is required by law in certain states. Those states requiring mines to provide such equipment are:

Alabama: Required to keep equipment indorsed by National Safety Council.

Arizona.

Arkansas: Where ten or more men are underground.

Colorado.

Kansas: Mine rescue stations and substations, as well as instruction of mines in rescue work, are required.

Kentucky.

Maryland: Equipment — rescue outfits; trained rescue crew required.

Michigan.

Montana.

Nevada.

New Jersey.

Ohio: Rescue cars and rescue stations required.

Oklahoma.

Pennsylvania.

Tennessee.

Utah.

Virginia: Where ten or more men are underground.

Washington: Where twenty or more men are underground.

West Virginia.

Wisconsin.

Wyoming: Stretcher for five or more persons.

The type of emergency service the miner may be called upon to render includes first aid to the injured, mine rescue work, artificial respiration, preparation of patient for transportation, and emergency treatment of such conditions as shock, burns, heat exhaustion, stroke, and accidental injuries. The need for this service in small mines is relatively as great as in large mines, and the discussion here applies more particularly to this group which cannot economically provide expert supervision.

Though it would be desirable to instruct every miner in these various services, this is not always possible. The foremen and a certain number of men to make up a team in each mine should be given a course in training under the immediate supervision of an authorized instructor of a responsible organization engaged in such instruction.

Training of the First-Aid Men

A very excellent course of instruction, training, and demonstrations regarding safe and unsafe practices in mining, mine rescue methods, and first-aid instruction is extended to miners through many safety stations and training cars of the U. S. Bureau of Mines. The authentic manual of first-aid instruction for miners published also by the U. S. Bureau of Mines should be used in connection with all first-aid courses for miners.

Interest in the subject of first-aid must begin with the mine owners and mine superintendents. Their support and co-operation are essential in order to promote interest among the men.

Convenient quarters equipped with first-aid requirements should be provided for the men who are willing to qualify themselves for first-aid service.

First-Aid Equipment

The equipment necessary for a first-aid service depends first upon the nature of the industry and second upon the availability of supplementary medical service near by.

For mine work the recommendations of the U. S. Bureau of Mines are as follows:

"At a suitable place on the surface and near the mine opening there should be a first-aid dressing station, which also can be used as a storeroom for first-aid supplies. In this building should be a stretcher, a woolen blanket, a waterproof blanket, and splints, all of which, except the splints, should be suitably protected from moisture and air in a sealed tin case or its equivalent. Also, there should be first-aid packets, containing one sterilized 40-in. triangular bandage, and one sterilized bandage compress, in germ-proof and waterproof wrappings suitably protected in sealed metal boxes, and first-aid cabinets.

Contents of First-Aid Cabinet

"Each cabinet should contain:

"Twelve sterilized 40-in. triangular bandages

"Twelve small sterilized bandage compresses, each gauze compress 1 in. square when folded upon itself about fifteen times, being sewed to the center of a 1-in. strip of muslin one-half yard long

"Twelve medium-size sterilized bandage compresses, each gauze compress 2½ in. square when folded upon itself about eighteen times, being sewed to the center of a 2½-in. strip of muslin 1 yd. long

"Six large sterilized bandage compresses, each gauze compress a 3½ in. square when folded upon itself about twenty times, being sewed to the center of a 3½-in. strip of muslin 2 yd. long

"Six packages of sterile picric acid gauze, each containing a piece of gauze 1 yd. square

"Six packages of sterile gauze 1 yd. square

"Four 2-oz. packages of absorbent cotton 4 in. wide

"Two 10-yd. spools of zinc oxide adhesive tape 2 in. wide

"Four 5-yd. gauze roller bandages 1 in. wide

"Eight 5-yd. gauze roller bandages 2½ in. wide

"Six splints of yucca or similar material

"One 2-oz. bottle of aromatic spirits of ammonia

"Six paper cups

"One teaspoon (horn)

"One tourniquet

"One pair of scissors

"One pair of tweezers for removing splinters

"Twelve ampoules of aromatic spirits of ammonia

"In mines the first-aid dressing stations should be maintained near the botton of the shaft or slope and on all working levels. One first-aid cabinet should be available for every 100 men or less and should be placed near all live workings. At least one man out of every ten employees should be trained in first-aid methods and carry a first-aid packet, which should be refilled when necessary."

An ample supply of oxygen breathing apparatus should always be on hand.

Because of the hazardous nature of mining, the distances over which it is often necessary to carry the injured, and the difficulty of procuring doctors, it is especially important that miners should be able to assist in case of accidents. Mining hazards are of such a nature that several men are likely to

be injured at the same time by an explosion or a fall of roof and several hours may intervene before those injured are seen by a physician or surgeon. The treatment given them during that interval is very important.

In addition to these provisions for emergency service whereby every man available can render aid to his fellow worker, a dispensary for the daily treatment of accidents should be provided.

A room or small building equipped as a dispensary should be located near the mine opening, if possible connecting with the dressing station and a storeroom for emergency supplies with an attendant on duty during all working hours. This attendant should be a male nurse or skilled first-aid man.

The dispensary need not be more than 100 or 200 sq.ft. in floor area. It should be well lighted by windows, thoroughly ventilated and well heated. A supply of running water, hot and cold, is essential. Electric outlets for various appliances should be provided.

The equipment of this room depends upon the nature and number of cases treated every day. The minimum requirements include:

An enameled metal or wooden dressing table
Two metal or wooden chairs or stools
A covered waste pail for discarded dressings
Two enameled metal surgical basins
A firm couch covered with washable material
Two blankets, preferably dark
A pillow with rubber cover
Towels, soap
A deep sink; preferably vitreous porcelain with chromium fittings
A first-aid kit or cabinet containing:
- Tincture of iodine
- Bandages and sterile dressings
- Finger dressings, 1½-in. compresses 3-in. compresses, a few 4x6 in. compresses
- Assorted gauze bandages of various widths
- Tourniquet
- Aromatic spirits of ammonia
- Adhesive tape and safety pins may be added.

The equipment listed is sufficient for a relatively small unit. In mines employing several hundred persons, in which there is a greater demand for first-aid service, additional equipment may be required, such as:

Small sterilizer—gas or electric
Various sterilizing solutions and drugs to be selected by physician
A few medical and surgical instruments to be selected by physician responsible for service
Cabinet for dressings and instruments
One or more portable screens
Soaking tanks or basins; a clock.
Chairs for waiting room
Desk and desk chair
Record file.

In most small first-aid rooms it is recommended that surgical dressings be of the individual unit type, single compresses attached to a suitable bandage, packed and sterilized singly. Dressings of this type avoid the very undesirable practice of using part of a package of compresses or of a portion of a sterile bandage, for the remainder saved is bound to become unsterile and if used subsequently may produce infection. Similarly, tincture of iodine in ampoules may be more serviceable than that kept in bulk, as the latter upon evaporation becomes dangerously concentrated.

It is important that surgical dressings be at all times stored neatly in a clean cabinet. Replacements should be made promptly, as required, one individual, preferably the attendant in charge, being made responsible for the maintenance and replacement of equipment. The maintenance of proper equipment is greatly facilitated by reducing the standard kit to the fewest items which may be found adequate for the needs of the first-aid service. As has been previously indicated, the equipment required for most first-aid work is very simple, and efficient standard practice is best carried on when no unnecessary material is stocked.

The work of either a nurse or first-aid attendant should always be supervised by a physician. During the physician's absence the attendant should have written orders from him detailing methods of treating cases until a physician arrives. Work should never be attempted which should be done by the physician or surgeon. Attempt should never be made to:

1. Set broken bones or reduce dislocations.
2. Flush or clean up serious wounds.
3. Remove imbedded foreign bodies, particularly those of the eye.
4. Administer any drugs except in an urgent emergency.

It is of the utmost importance that, even in the most rudimentary first-aid room, an accurate record be made of first-aid service rendered in each case. Such a record should be made promptly and include the date, the name and possibly the number of the employee treated, a statement of the nature of the injury, and a notation regarding the treatment offered and the disposition of the case, whether returned to work or sent home, to hospital, or physician. The record may be kept upon a "day sheet" or upon an individual record filed under the name of the employee. When indicated, cases should be carefully followed up to insure adequacy of treatment.

Changes Reduce Temperature of Turbine Bearings

RECENT innovations at the steam power plant of the Miami Copper Company, at Miami, Ariz., include (1) the method of supplying cooling water at a constant pressure of 13 lb. to the water-cooled bearings of a 13,000 kva. steam turbine; and (2) the procedure employed to effect a more rapid flow of oil through the oil-cooled outer bearing of the generator unit to obtain lower bearing temperatures.

Prior to the tank installation, as shown in Fig. 1 in the accompanying illustration, the necessary cooling water was obtained from the main supply

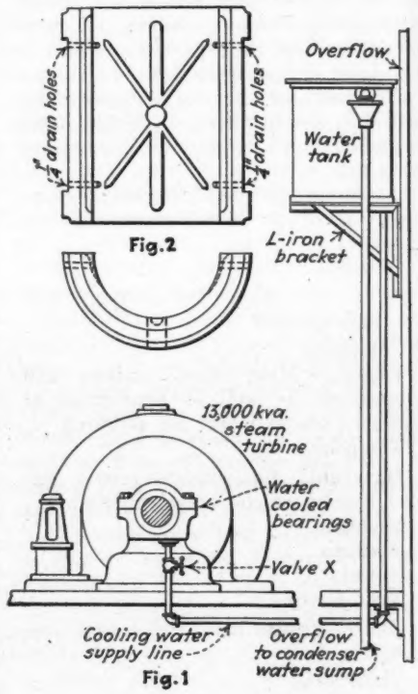

Fig.1

Sketch of tank installation

tank. Because of the rising and falling water level, the operator had to regulate continuously the flow of the water to the bearing, with the aid of valve *X*, to insure an even temperature. To overcome this difficulty a small water tank was installed at a height to deliver the water at about 13-lb. pressure to the water inlet of the bearing, thus eliminating regulation of valve *X*, which is now constantly open. To maintain an even water level, the tank is provided with a simple overflow system, the discharge pipe of which returns the excess water to the condenser water sump for further use.

To effect a more rapid flow of lubricating and cooling oil through the generator bearing, four ¼-in. diameter holes were drilled through the bearing walls in the oil pocket section, as shown in Fig. 2. With this alteration the bearing temperature was decreased from 154 to 134 deg. F., according to E. B. Lane, power-plant engineer.

TRACK CURVATURE CHART

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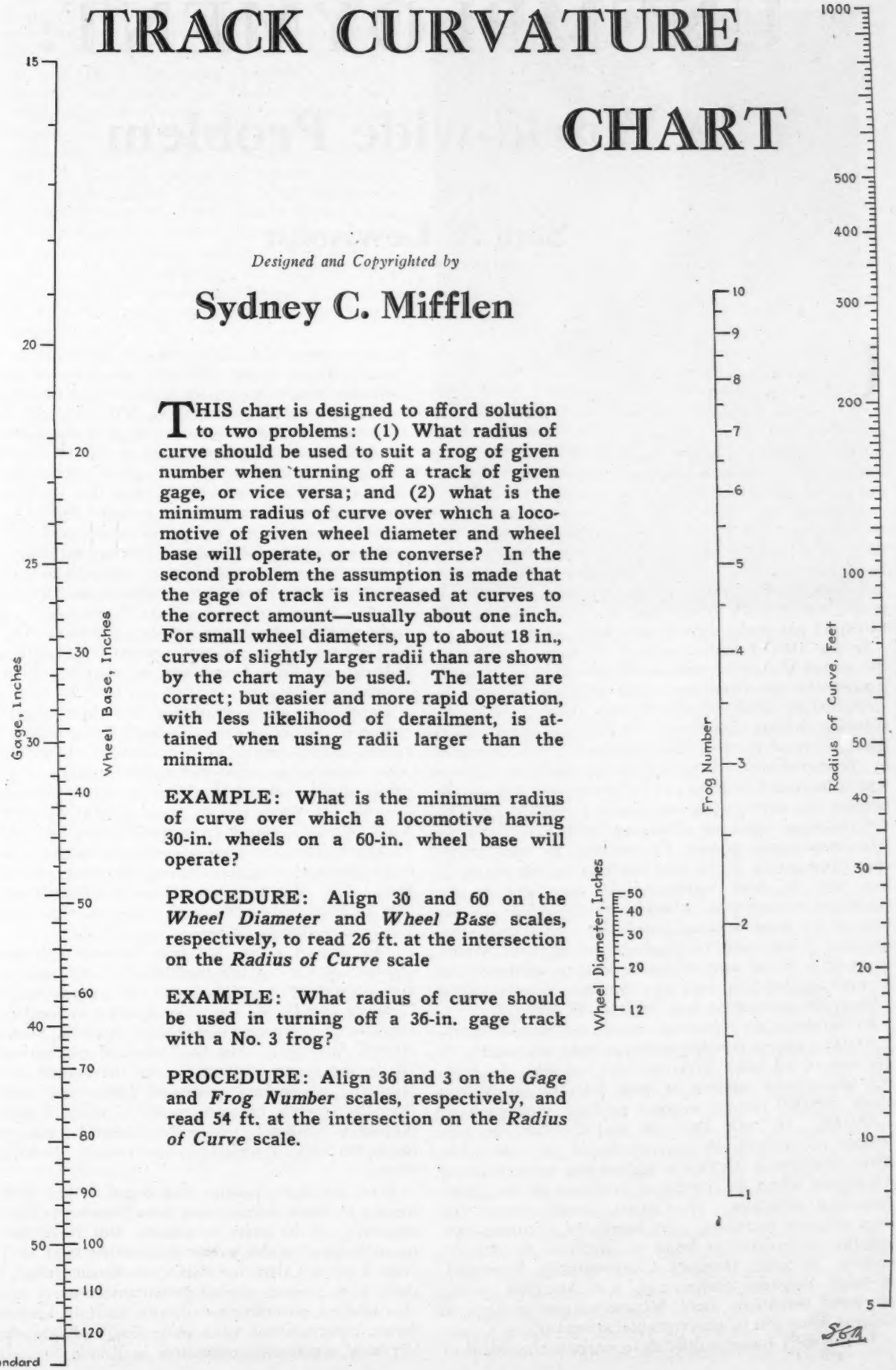
Sydney C. Mifflen



THIS chart is designed to afford solution to two problems: (1) What radius of curve should be used to suit a frog of given number when turning off a track of given gage, or vice versa; and (2) what is the minimum radius of curve over which a locomotive of given wheel diameter and wheel base will operate, or the converse? In the second problem the assumption is made that the gage of track is increased at curves to the correct amount—usually about one inch. For small wheel diameters, up to about 18 in., curves of slightly larger radii than are shown by the chart may be used. The latter are correct; but easier and more rapid operation, with less likelihood of derailment, is attained when using radii larger than the minima.

EXAMPLE: What is the minimum radius of curve over which a locomotive having 30-in. wheels on a 60-in. wheel base will operate?

PROCEDURE: Align 30 and 60 on the *Wheel Diameter* and *Wheel Base* scales, respectively, to read 26 ft. at the intersection on the *Radius of Curve* scale

EXAMPLE: What radius of curve should be used in turning off a 36-in. gage track with a No. 3 frog?

PROCEDURE: Align 36 and 3 on the *Gage* and *Frog Number* scales, respectively, and read 54 ft. at the intersection on the *Radius of Curve* scale.

UNEMPLOYMENT:

A World-wide Problem

Sam A. Lewisohn
Vice-president, Miami Copper Company

UNEMPLOYMENT at the present time is probably as nearly world-wide as it has been at any time since the deflation period in 1920-21; in some respects the problems of unemployment are now more complex because of the tremendous and intricate industrial changes in the past decade. And in most countries unemployment has been steadily increasing during the past year.

Even the briefest personal observation and study of official reports on unemployment reveal the fact that there are profound differences in the very nature of the unemployment in the different countries. But so little is definitely known even as to the extent, the number of people out of work, that it may at present be too much to expect any really definite knowledge as to causes.

In the United States, without becoming involved in the statistical controversies of officials, there is obviously considerable unemployment; and whether the total be 2,500,000 or 4,000,000, the mining industries are contributing at least their share. In England, where official registration of most of the unemployed is necessitated by the distribution of unemployment insurance, the extent is more definitely known. At the present time, the number of unemployed registered exceeds 1,750,000; and this figure does not include agricultural workers and other considerable groups. Of this total, the metal trades contribute nearly 18 per cent and coal mining nearly 15 per cent, or, both together, about one-third of the registered unemployed, which represents about 14 per cent of the total working population. In typical communities in the north of England and in South Wales, from 25 to 45 per cent of the working population is out of work and has been for many months. In some mining villages the proportion is as high as 90 per cent.

In Germany, the registered unemployed number nearly 2,500,000, almost doubled within a year, and nearly 25 per cent of all labor union workers are idle. In Italy, the unemployed number at least 500,000; in Austria about 300,000 out of a total working population of 1,200,000. In both Denmark and Sweden the percentage of workers idle is now over 17 per cent. The silver situation in Mexico is aggravating unemployment conditions, which are disturbing in almost all the Latin-American countries. In Canada, unemployment has been seriously increasing. In Japan, the unemployment situation is reported as being the worst in the nation's history. In Spain, Hungary, Czechoslovakia, Roumania, Holland, Belgium, Switzerland, and Australia, unemployment conditions have become serious enough to demand some sort of governmental attention.

In Russia, I found it difficult to estimate the extent of unemployment from observation. Semi-official figures have indicated about 1,750,000 unemployed; unofficial estimates have ranged much higher. Because of the disorganization in many industries, it is frequently hard to tell whether a man is really employed or not, particularly in agriculture. However, there is considerable unemployment, of which the government is fully aware.

In striking contrast, France has had practically no unemployment in the post-war period. However, I observed some business symptoms which were not altogether reassuring for the future. After the War, France found itself with its man-power inadequate for reconstruction, and hundreds of thousands of Belgians, Italians, Slavs, and Poles were "imported." As the work progressed, many of these went home, but those who have stayed are unemployed in increasing numbers, although, not being French citizens, they are not counted in official statements.

Limitation of immigration and more and more stringent restrictions are constantly being called for to relieve unemployment in each country. In response to these demands in Great Britain, for instance, a government official declared that it is already practically impossible for foreigners to come into the country for work without a permit from the Ministry of Labor. In Portugal there has been a decree forbidding the new employment of foreigners during the present unemployment crisis. But the United States has limited immigration for some years without preventing the unemployment which so obviously exists.

The idea of tariffs has been revived with new enthusiasm in the last few months as an economic method for preventing unemployment. "Safeguarding" and "Empire free trade" are being agitated in England, for example, as the means of salvation from the present industrial depression. But the United States has had high tariffs for years, particularly for the benefit of those industries which have continued during that period to have the severest unemployment. And, in Russia, importing is absolutely under the control of the government and many commodities are entirely forbidden to enter.

Now, and since politics first began, it has been customary to blame idleness and breadlines on politics, and especially on the party in power. But there has been unemployment under every conceivable kind of party, from Tory to Labor, for instance, in Great Britain. And there is at present unemployment under every conceivable kind of government—dictator in Italy, emperor in Japan, constitutional monarch in England, president in Germany, communist committee in Russia.

Nor are general business conditions the uniform cause of unemployment. Employed capital means employed labor; that is largely true. Germany has been hungry for capital, and this is the reason frequently cited for unemployment. But hasn't the United States been choking with capital? British industry is declining, Japan's is growing; both have unemployment.

There is no uniform cause among industries. The coal industry may be declining and the oil industry growing; and there is unemployment in both. Even within the same industry there may be unemployment in two plants or mines for exactly the opposite reason; one may be dying out because of obsolete machinery and methods, and the other may be improving its machinery and methods and laying off unnecessary labor. Unemployment may be a symptom of decay—and it may be the price of progress.

In every country I have visited during the past year I have been met with the final argument that the present unemployment is due to world-wide depression; followed by the cry that the government must do something. Undoubtedly the general business recession has aggravated unemployment; but even in prosperous times every industrial country has a "normal" unemployment totaling hundreds of thousands, and even millions. Who can say which is the cause and which the effect, unemployment or depression? Are not these two conditions so interacting and cumulative that they are practically identical? To say that depression causes unemployment is like saying that a headache is caused by a pain in the head.

As for the government of each country doing something about unemployment, there are undoubtedly many things which governments could do, but a large proportion of measures usually urged are unnecessary and generally have little or no effect in preventing unemployment. It is too easy to pass the problem on to the government, and whenever business begins to recede, business men immediately call on the government, no matter how vigorously they may resent "government interference" when times are good.

But unemployment is a government problem only so far as business is a government problem, which means that it is the government's concern only because business men are unwilling or unable to deal with their own problem. Unfortunately, this unwillingness and inability appear to be wide, deep, and continuous.

The government can, logically, serve as a centralizing agency for activities which deal with the problem; it can maintain a constant survey of all broad economic conditions beyond the resources of the individual employer or particular industry; it can always serve as fact-finder and guide; it can, logically, deal with those international relations which influence employment. But if all employers were to apply those methods of management which are already known and tested, the amount of chronic unemployment would be so reduced that the proportion left to government treatment would be comparatively unimportant.

Analysis of the real causes of unemployment reveals which of these causes are within the possible control of each element in our economic system. Those causes which may be considered as controllable, to some extent, by the individual worker, include those related to inadequacy in competence, temperament, or health; and even in these, in many cases, responsibility comes nearer the employer than the employee.

In the case of mass unemployment, causes may be

A recent portrait of Mr. Lewisohn

casual, due to irregularity in operations; seasonal; technological, due to replacement of labor by power; competitive, due to defeat of one industry by another in the competition between industries; cyclical, due to broad economic conditions.

With modern knowledge of production and distribution, there is no real excuse for casual or seasonal unemployment in most industries. It has been proved by a large number of businesses, large and small, in a wide variety of industries, that seasonal unemployment can be reduced to the point of elimination. By planning operations and by taking advantage of markets, it is possible for a large proportion of employers to cut down unemployment in their own businesses. This is not a government function, and those business men who permit their employees to go idle at certain seasons are simply shirking their responsibilities and proving the inadequacy of their management.

The unemployment which afflicts whole industries, as, for instance, when cotton is supplemented by silk and rayon, or coal by oil, or, perhaps in the future, iron by aluminum, may seem to be impossible to control. But those industries which foresee this type of competition and use the proper means to meet it, do not die out. The structural steel industry is increasing its markets, for instance, in the face of the strong competition of cement, which has already won from steel millions of tons.

Where it is impossible to sustain an industry, its unemployed are faced with the same problem as those thrown out of work by technologic improvements. We have been reassured by some optimistic economists that technological unemployment is not serious; that those released from one industry go into the new industries. This optimism might be tempered by the fact that this

is by no means always the case and that, in probably every case, there is a definite break in employment, sometimes lasting for a considerable period, while the shift from one industry to another is accomplished.

As for cyclical unemployment, of the type through which we seem to be passing at present, there is little really known about cause and remedy. But it is more than possible that one cause, at least, is the accumulation of the underemployment which is with us all the time. Unemployment breeds more unemployment. Seasonal unemployment always aggravates cyclical unemployment and makes general business recovery more difficult. There will always be some unemployment, of course, but it is economic cruelty to talk of "normal unemployment" in such numbers as we have been hearing during the past year in every industrial country.

If thousands and hundreds of thousands of workers must be shifted from one industry to another because of competition and technical improvements, then that shifting must be made as painless as possible for the individual and as economical as possible for industry and the nation. If a certain amount of job-losing is necessary, then the task of job-finding to balance it must be made as simple as possible.

The machinery for getting worker and job together is utterly inadequate and wasteful in most industrial countries. It is obviously so in the United States. Even the most efficient commercial agencies can do very little. Something much bigger and better organized is needed to give labor the mobility it needs. Hand-to-mouth distribution is possible because transportation is efficient; if we are to have a hand-to-mouth labor policy, the movement of labor must be made efficient.

The public employment agencies in some of the more progressive countries of Europe have developed excellent methods, but they are naturally helpless before such a flood of unemployed as swamps them at present. In the United States the public employment agencies, with three or four exceptions, have never been able to prove the value of the principles they represent. Not only have they been unable to develop the machinery and technique for connecting worker and work, but they have never had an opportunity to do even the most elementary kind of job in handling such unemployed as came to them.

The public employment agencies available—and available only to a very small proportion of workers anywhere in the United States—have been operated on the idea that all that is needed is a room, a desk, and a man. The salaries offered have been such as would demand real sacrifice from any but the poorly qualified. Facilities and resources have been inadequate to attract the idle or to reach the prospective employers. The offices have been further handicapped by the indifference, and even antagonism, of both labor and employer organizations.

When unions and trade associations realize that employment agencies are the only logical machinery for minimizing such unemployment as seems inevitable, then will the unemployment problem be on the way to solution.

No town should permit a worker, whose taxes and buying power support it, to become a charity case, or to move out, if it is at all possible to find the right job for him. No industry should lose a skilled worker who has spent his life learning his trade, because the skill, efficiency, and loyalty of its workers are an industry's greatest assets. Any trade union which permits a cardholder to go idle is failing in its first obligation.

It is true that the technique of employment agencies has still to be worked out; but there is no reason why it could not be perfected very quickly with the proper support. All that is needed is a few model agencies organized by the joint efforts of labor and employers, with, perhaps, local or federal government aid and guidance, if necessary. But there must be money and co-operation; enough money to pay for a competent staff and facilities, and enough co-operation to make them effective.

Ultimately we may have a real system of employment exchanges, organized both geographically and industrially, so that each locality and each industry not only provides, as far as possible, for its own workers, but is tied in with every other in some form of co-operative clearing-house system.

But these measures of employment agency and unemployment insurance are essentially relief measures. They are not preventive in themselves. Under no circumstances must the entire burden of dealing with unemployment be placed on them. Never during the course of the development of such systems may either worker or employer be allowed to believe that either is a panacea. It is not, and there is no panacea for unemployment in any country nor in any industry. There are remedies for each individual cause, and most of these remedies are within the power of each employer to apply, alone, without government aid, without tariffs, without elections.

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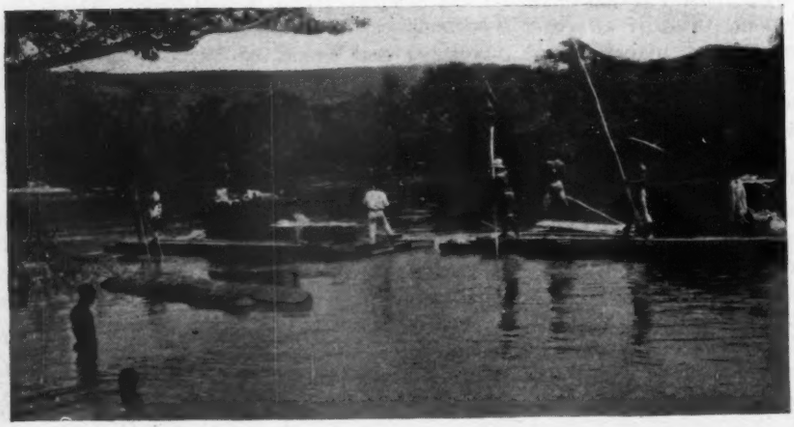


River-freight transport, Bahia, Brazil

Shaft Concreting at Zaruma, Ecuador

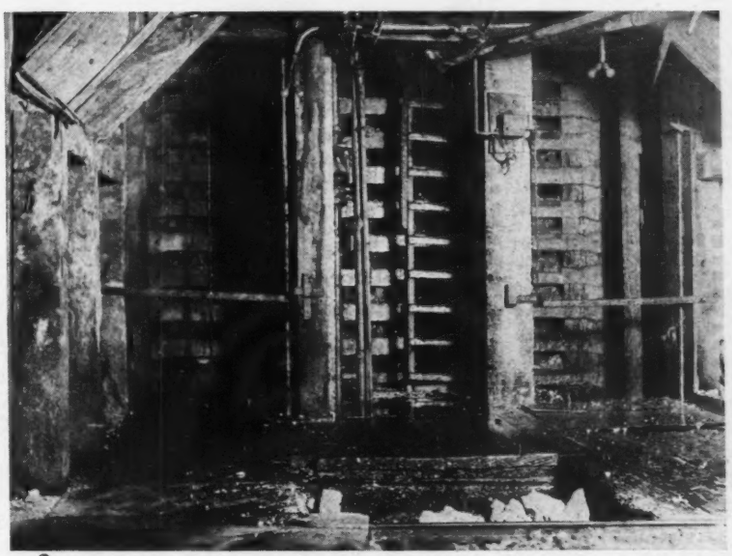
Marcus D. Banghart

Mine Foreman, South American Development Company

THE mines operated by the South American Development Company are situated at Portovelo, in the Zaruma mining district of southwestern Ecuador, 74 km. from Santa Rosa, the nearest coast town. At present the only mode of traveling or of transporting supplies from the coast is by muleback—a good two days' trip. The mines produce about 10,000 tons of gold-quartz-calcite ore a month, and comprise several units, the principal units now in operation being Portovelo-Abundancia, Jorupe, and Agua Dulce mines. The Jorupe and Agua Dulce mines are entered by tunnels and adits, and have a combined tonnage of about 2,500 tons a month. At the Portovelo-Abundancia mines the main entry is the American shaft, through which nearly all of the balance of the tonnage is hoisted.

The American shaft is vertical, and is collared in the hanging wall of the Abundancia vein, a short distance south of where this vein intersects the Portovelo vein. Levels have been driven at 30-m. intervals, down to the eleventh level. The shaft has two compartments from the surface to the seventh level, then three to the ninth level, and two from the ninth to the eleventh level. The compartments were originally 50x 60 in. in the clear, but, with the new lining, have been increased 2 in. each way. At present the shaft is being used down to the eighth level only, the lower section serving as a sump.

Originally, the shaft was timbered with ordinary shaft sets of 7-in. timbers, placed on 6-ft. centers. From time to time these were replaced or repaired, but, by the early part of 1927, the timbers throughout the whole shaft were in such condition, owing mostly to rot, that relining of the entire shaft was imperative. Timber construction was not desirable, because experience had demonstrated that even the better native woods did not stand up under shaft conditions. Foreign timber could not be used, on account of the expense of importation and difficulty in transportation. Various methods of using concrete were discussed and studied. Small storage capacity on the surface, coupled with a low-speed hoist, necessitated almost continuous hoisting of ore and waste during two shifts, leaving only eight hours a day for repair work. It was anticipated that even this eight-hour period would be interrupted by handling the shift and necessary supplies, so, that, without decreasing normal production, only about five hours out of each 24 hours would be left for actual repair work on the shaft. Mr. Ivan Landes, formerly construction superintendent for the company, suggested the



The shaft at the seventh-level station. The wood-block bricking can be seen on the right, in the main hoisting compartment.

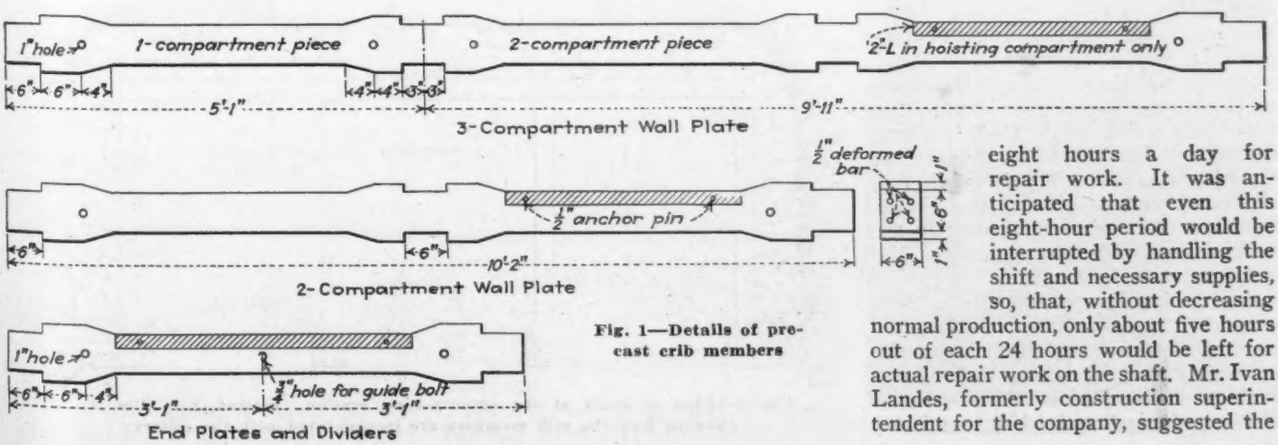


Fig. 1—Details of precast crib members

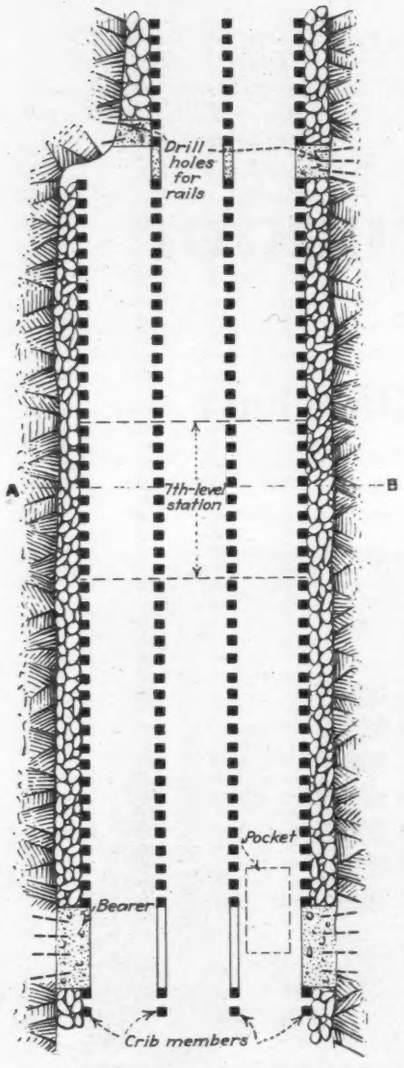


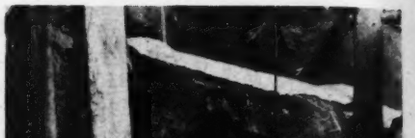
Fig. 2—Vertical section of part of the shaft, showing bearers, crib members, and backfill

use of pre-cast reinforced-concrete members, in the form of a crib. On analysis, this scheme seemed to promise the minimum of interference and maximum speed, and, incidentally, the minimum of expense. The suggestion was therefore followed.

Accordingly, crib members, 6x6 in. in cross-section, and reinforced with ½-in. deformed-bar reinforcing, were designed; they were cast with lugs to prevent movement inward. The two-compartment wall plates were cast in one piece, but the three-compartment plates were cast in two pieces because the added length and weight made handling difficult. A 6-in. space prevails between the members, and, after the work was started, it became evident that unless the upper edge of each member in the hoisting compartment was protected, the member would be gradually cut out by falling rock. To remedy this, a 2-in. angle iron was cast into the member so as to protect this upper edge. In the corners where the falling rock is the heaviest, the use of wood or concrete blocks in the form of bricking was found to be advisable. Owing to the shape of the lugs, extension of the angle iron to the corners was not feasible.

Because much of the blocking of the timber sets had rotted and fallen away, these sets first had to be secured so that the upper sets would not move when those below were taken out. This was accomplished by means of scabbing sets and temporary blocking, and by suspending them with used hoisting cables. These cables were fastened to the rock wall, about 30 m. above, by means of eyebolts anchored in drill holes. They were then dropped outside of the shaft timbers, and looped around the bottom set and clamped. The slack was next taken up by turnbuckles. One cable was used at each corner and at each end of the dividers.

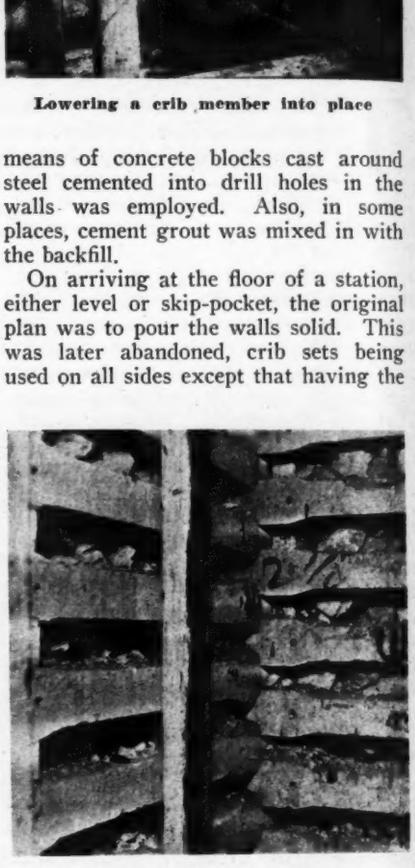
After this preparatory work, the old fill was removed, and work on a concrete bearer was begun. The bearers were in the form of a heavily reinforced ring, and were tied into the walls by means of pieces of old rails, upset and hammered out on one end so as to fit into short drill holes. When the rails were in place, concrete was poured solid to the walls. With the bearer poured, the placing of the crib sets was begun. Inasmuch as the old timber sets were on 6-ft. centers, room was available to put in six crib sets for each timber set removed. In removing the timber sets, the procedure usually followed was to block at the bottom the set held by the cables, move the cables up a set, then remove the bottom blocks and the set formerly sustained by the cables. With this part of the work completed, the placing of crib members was simple and rapid. Before another timber set was removed, the space between the cribbing and the walls was backfilled with rock. At first a small-section chute was built in the manway compartment, and waste from the level above passed through it. Scrap-iron sheets were used as back lagging to hold the fill. This procedure proved to be too slow, so large rock was brought down on the cage and used instead. With this method of filling, the sheets were unnecessary. Where the ground was bad, blocking by



Lowering a crib member into place

means of concrete blocks cast around steel cemented into drill holes in the walls was employed. Also, in some places, cement grout was mixed in with the backfill.

On arriving at the floor of a station, either level or skip-pocket, the original plan was to pour the walls solid. This was later abandoned, crib sets being used on all sides except that having the



Part of the hoisting compartment at the third-level station

opening or openings. Here pillars, 18 in. in cross-section, were poured at the ends of the end plates and dividers. The pillars extended from the floor to the back, and, whenever possible, they were bonded to the walls of the country rock.

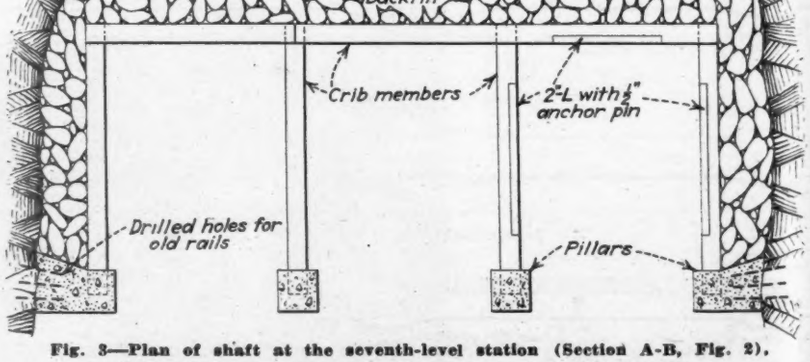


Fig. 3—Plan of shaft at the seventh-level station (Section A-B, Fig. 2), showing how the crib members are incorporated with the pillars

A flat slab was poured to cap them, so as to hold the fill above. The cribbing was then continued on all four sides.

As the shaft was in the most dangerous condition between the third and fifth levels, this part was repaired first, but before this section could be finished the part from the fifth to the eighth levels had become so bad that a great deal of maintenance work was necessary here to keep the shaft open for hoisting. With all of these delays, the average advance of the concreting was about 7 m. a month, although from 10 to 15 m. was made when no time was lost doing maintenance work on the old timber.

The shaft crew consisted of six to eight men and a working boss, all native Ecuadoreans. Their wages in dollars ranged from $0.80 a day for timber helpers to $2 a day for the best-grade carpenter. The boss was a native gold-payroll employee.

To date only two crib members have failed, and, inasmuch as they failed soon after being installed, the weakness was probably the result of poor concrete. They were noticed immediately, and the old concrete was picked out, the space being poured solid with new concrete. The bearers varied from 2 to 6 ft. in thickness, depending on the condition of the walls and the height of the cribbing they had to support. For both bearers and pre-cast crib members, the mixture used was 1:2:4. The aggregate was made up mostly of andesite waste rock obtained from the mine. When properly screened, it made a good aggregate—much better than local river gravel. In pouring bearers, the concrete mixer was placed in the station of the first or second levels above, and the mixture dropped to the forms through a 4-in. pipe. In the longer drops, considerable attention was paid to spading the concrete so as to eliminate segregation of the fines.

To give unit costs is impossible, because with varying freight rates from the coast, both reinforcing and cement ranged through a wide scale of prices. Cement, for example, ranged from $2.29 to $3.59 per 94-lb. sack, the average cost being about $2.85 per sack. This price included a necessary water-proof sack, in addition to the regular sack. Steel reinforcing averaged $0.045 per pound. On the basis of these figures, the cost of one complete two-compartment set—that is, two wall plates, two end plates, and one divider—was $15; similarly, the cost of one three-compartment set was $22. These costs do not include the expense of installation, being only the actual cost of manufacturing the sets. Total costs, including installation, were as follows:

	Per Meter	Per Foot
Labor	$77.32	$23.57
Supplies	111.86	34.09
Total	$189.18	$57.66

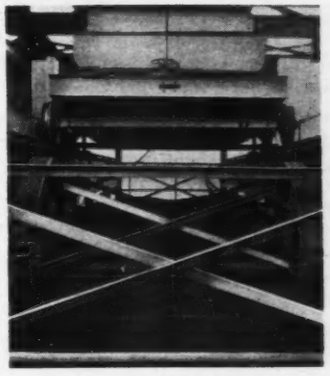
These costs include all labor and supplies used in taking out the old timber sets and replacing them with concrete sets, but do not include maintenance work on the old timber previous to its removal.

The aim of concreting the shaft without interfering with production was accomplished. In fact, the tonnage hoisted through the American shaft during the work was greater than had been anticipated at the beginning.

Automatic A. C. Larry Car

A. F. Gettelman

General Electric Company, Duluth, Minn.

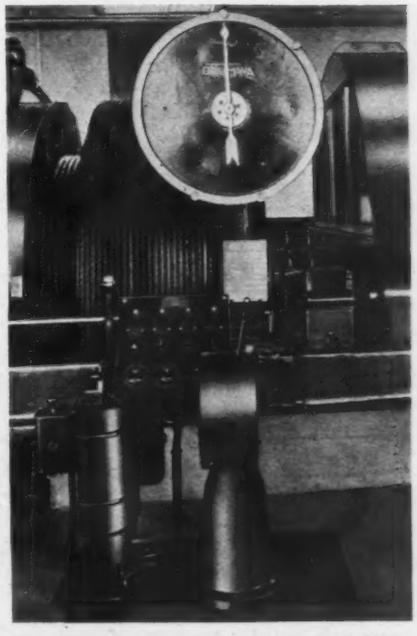


Larry car and dumping arrangement

LAST year the M. A. Hanna Company placed in operation at its Susquehanna mine an automatic a.-c. larry car, the electrical equipment of which is interesting. The Susquehanna is one of the deepest open-pit iron mines on the Mesabi range, and, on account of its great depth, mining by the mill-hole method is employed. The ore is loaded in the pit by electric shovels into motorized dump cars which convey it through a tunnel cut in the side of the pit to a vertical shaft through which it is hoisted by skip to the surface above the pit and dumped into the automatic larry car. This conveys it to the proper pocket for dumping into the railroad cars.

The larry car is operated by means of a rope and a 7½-hp. slip-ring induction motor through suitable reduction gearing and rope sheaves. Its control equipment consists of a control panel on which are mounted the necessary contactors and time relays, a signal panel for the skip attendant at the bottom of the shaft, and an operating panel for the hoist man. Three limit switches are used to control the limit stops. The car is tripped for dumping at the end pockets by means of permanent dumping horns and at the inner pockets by air-operated dumping horns controlled from the panel by means of solenoid valves. There are four pockets under the larry car tracks, two in each direction of travel from the loading position at the headframe.

The larry car is operated as follows: The skip attendant's panel contains four ammeter jacks, and if, for example, No. 1 ore is being hoisted, he plugs into No. 1 jack, lighting a corresponding indicating lamp on the hoist man's control panel. Under each indicating lamp on this panel is a corresponding ammeter jack. The hoist man, on receiving the signal on for No. 1 ore, places his plug in the No. 1 jack, thereby setting up the proper control sequence to send the larry car out to No. 1 pocket. Upon receiving the bell signal from the skip attendant, he hoists the ore and dumps it into the larry car. He then presses the "start" button on his panel, the larry car travels to No. 1 pocket, stops, and dumps the ore. After a time delay to insure complete dumping, it returns to the headframe for another load. A green light on the hoist man's panel indicates that it is in position for receiving another skip load. The time for the complete cycle of the larry car is somewhat less than the hoisting cycle, so that the car can handle the full production of the mine.



Hoist and larry-car control panel

Reorganizing the Tin Industry by Co-Operation and Research

Alfred James

AN "economic" price for tin has been determined, based on actual and probable costs, and the requirements of investing capital. A common fund for research is proposed. The coalescence of the smaller operators and some plan of group co-ordination are essential to success.

IN THE two previous articles of this series I gave graphs and calculations which show that at December, 1929, a price of £240 a ton was essential to stimulate production of adequate supplies of tin four years hence. Production at any date is regulated naturally by the price of the metal from two to four years previously. Many of the boom-induced companies of 1927 are only now coming into production. I add calculations based on figures other than my own, extracted from a thought-compelling article by Mr. John Howeson in the monthly bulletin for August, 1929, of the Anglo-Oriental Mining Corporation, Ltd., in which he states:

"The capital invested in the dredging industry at the end of May, 1929, amounted to £12,856,098. This represents the capitalization of 120 dredges, of which 96 were at that time in actual operation. The average capital per dredge is therefore in the neighborhood of £107,100. According to statistics from the same source, the dredging industry produced, in the five-month period, 9,908 tons of metal (13,761 tons of concentrates). This represents the production of 450.5 dredge-months, equivalent to an average of 265 tons of metal (368 tons of concentrates) per dredge-year. The tendency toward the installation of bigger dredges is mainly responsible for the rise in this figure as compared with 1928, when production averaged only 235 tons of metal per dredge.

"It is therefore permissible to say that, under present conditions, £107,100 invested in dredging produces, on the average, 265 tons of metal. On this assumption the average amount of capital in the industry is £404 per ton of metal produced, or £291 per ton of concentrates. . . .

"We have thus apportioned the following capital charges on dredging investments:

	Per Cent
Amortization and depreciation	6½
Overhead charges	4
General reserve and surplus	1½
Sundry charges	2
Interest	6
Total	20

"Every ton of concentrates, therefore, must pay, on the average, 20 per cent of £291, or £58.2, before it can be accounted profitable. . . .

"The economic price of tin for dredging companies of different mining costs, assuming average capitalization and fifteen years' working life, is as follows:

Maximum Mining Costs, per Ton of Concentrates	Tin Price, per Ton of Metal
£38.6	£160
44.6	170
50.7	180
56.8	190
62.8	200
68.9	210
74.9	220
81.0	230
87.0	240
93.1	250
99.1	260
105.2	270
111.2	280
117.3	290
123.3	300
129.4	310
135.4	320

"If this estimate is even approximately correct, the economic price is about £250 per ton."

I feel that even this price may underestimate the position, because the investor is not satisfied with 6 per cent interest on a mining proposition. Herbert Hoover, in his book entitled "Principles of Mining," shows that a higher interest is needed. J. H. Curle states plainly that the interest must not be less than 15 per cent—but this covers amortization. With the tin industry modernized and controlled by a group of men with experience and huge financial resources, one can with sufficient safety rely on the necessary capital being provided for 8 per cent plus amortization (at 4 per cent interest). I am given to understand this is the basis adopted by the taxation authority of the United States. Less than this drives the investor to bonds.

The question of the regulation of world supply of tin is particularly attractive to many minds. Total output is small—under 200,000 tons per annum. It is scattered over many units. The marketing of the metal in the past has been unorganized. All this apparently offers an opportunity to some man of resolution, enterprise, and capital to modernize the industry. We who were born in the tin industry have great faith in the law of supply and demand—the killing out by slump prices of boom-induced uneconomic overproduction. But a study of conditions in other industries convinces even us that, though producers may make up in times of boom what they lose during periods of slump, the consumer would welcome steadier price conditions. These would enable him to plan intelligently his forward policy, and would avoid his usual disastrous heavy purchases at the peak of the boom as a sequel to holding off the market during periods of rise. Similarly, the producer would benefit from the more regular purchases of the consumer and from the absence of that period of low consumption, immediately after a boom peak, during the disposal of goods made from tin purchased at high prices.

But, however attractive the problem of regulation of supplies, an essential step would seem to be the gathering of producers into fewer groups. Without this, outsiders, particularly the numerous small outsiders who collectively account for considerable production, may endeavor to ride on the backs of the stronger companies, who may agree to restriction of output for the benefit of the industry as a whole and not because it is necessary in their own case. Any attempt to adjust tin supplies before the producers come together seems bound to induce the uneconomic concerns still to continue to struggle on, even at the cost of continuous loans, issues of fresh capital, or increase in debts, in the firm belief that the action of others is going to solve their troubles. The only result is to make the position appreciably

This is the third and last of a series of articles on the economics of tin production. The first, entitled "Tin Industry Faces the Facts," appeared in the Aug. 23 issue; the second, entitled "Tin Prices and Production," appeared in the Sept. 8 issue.

worse by adding to overproduction. I incline to the view that unless producers can get together, until perhaps as few groups are concerned as in nickel production, or in that of aluminum, any attempt to regulate output can scarcely succeed.

The regulation naturally exercised by a big producer—such as the Dutch government—is on the lines of cutting off higher-cost production as the price of tin falls. Losses are thus minimized without addition of uneconomic tin to stocks. The industry has to put itself into a similar position to that of the Dutch government. Then and not until then can we really expect efficient rationalization of the industry.

Where mineral deposits form an appreciable part of the wealth of a state, as in Bolivia, Nigeria, and Malaya, one can understand a government, the royalties of which usually depend on prices realized, forbidding the sale, at less than an agreed normal averaged price, of concentrate derived from its leased lands. Such a step would undoubtedly assist regulation of supply to demand.

Two major influences affect the market price of the metal. First is the greatly increased output—in one year three leading companies, each of different grouping, quadrupled their average monthly output—and lessened cost of production in the Malay States, arising out of the success of the huge dredges with jigs. The fact that these dredges have already cut "mining" costs by half renders available a quantity of tin-bearing ground hitherto considered uneconomic. This factor and the multiplication of gravel pumps both in Malaya and Nigeria and the increased output from the Patiño mines have produced a situation possibly without parallel in the industry. The other major point is the effect of the formation of a Tin Producers' Association and of the propaganda leading up to this. Probably the effect of the latter at the outset will be the reverse of that hoped for. The greatest and best-known economic tin producers of the world are regarding the action of the Tin Producers' Association with benevolent consideration, and are taking sympathetic action not necessarily imposed by market conditions. But the effect of all this propaganda may be to induce many uneconomic producers to hold on in defiance of their own high costs and inability to meet market conditions.

The loss of money by the gullible is as natural as folly to a fool, but one could wish that other means for the losing of their money might prove more attractive to the gullible than that causing so terrible a loss to efficient and economic producers. If one assumes the loss of profit for the last year arising from the thrusting on to the market of uneconomic tin to be £45 per ton, then the loss on 160,000 tons of economically produced tin amounts to over seven million pounds sterling—a high price to be paid by the industry for the folly of speculation. The question cannot but have arisen in the minds of the thoughtful as to whether or not it would be quicker and more effective to allow tin to drop to its lowest level unhampered by any restrictive schemes or by the lifting of metal off the market. In this case the uneconomic producers might be cleared out. Another famine would result. Could supplies be controlled better after the producers have been frozen out than while they are being still induced to hang on by the methods that are destined to prevent or alleviate a collapse in price? I think not.

The consumer must be considered as well as the producer. The recent statements by Henry Ford and Sir Henri Deterding show how anxious the industrial world is that the bumps should be eliminated. Mr. E. B. Cosgrove in his recent speech as president of the National Canners' Association states, "Industry wants blind chance-taking and gambling eliminated from business." A rationalized far-sighted production is the only way to avoid the famines which in the past have so affected the tin industry. I doubt if rationalization will ever be effectively accomplished until the industry has provided for the dumping on to the market, at any time within twelve months' notice, of an extra supply of not less than 20,000 tons of tin for the purpose of averting such famine as prejudiced the industry in 1926-27. The knowledge of such provision would probably be the most effective deterrent to the flotation of non-economic companies.

An attempt to dispose during 1930 of 60,000 surplus tons without first finding a use for this metal is not only futile but suicidal. It means that the tin purchased at dump prices replaces other tin for which normal prices would be paid. Probably an effective step will be the stimulation of contributions to a common fund devoted to research for the development of new and extended uses for the metal. In this all producers will naturally be keenly interested. This is a matter of such major importance that it might be well for shareholders to urge their boards to devote to "service" a sum of five shillings per ton of output.

One is likely to overlook the concentration on service that is now common to modern production and salesmanship. The United States has nothing to learn in this matter: the Rotarian Club, the pulpit, the business colleges, her own receptivity of experience and her ability to learn therefrom, all culminate in a natural or acquired keenness to render service, and the industry of the nation profits accordingly. It may be that the tin producer has yet to learn this lesson. A contribution of five shillings per ton of output, and the allocation of this to research, might well be a first step in Service.

But, above all, let the producers come together, as also the smelters. Let the latter decide monthly in advance the amount of oxide required to meet the needs of the industry. During that month let the smelters buy the agreed amount of oxide and no more. I append a suggestion: Let us assume the producers of two-thirds of the tin output of the world gathered into an association, and that these producers subscribe to a common fund £5 per ton of metal produced, or such sum as would amount to, say, half a million pounds sterling per annum. The purpose of this fund would be to pay 3½ per cent per annum on a capitalization of £300 per ton of tin not produced, basing on agreed normal production. Mines receiving this allowance not to start producing except at three months' notice, when receipt of the allowance ceases. An abstention of 50,000 tons a year at £300 per ton not produced would correspond to an issued capitalization of fifteen million pounds sterling, to pay the dividend on which the above fund would suffice. An actual restriction of 50,000 tons of tin a year should forthwith restore tin to its economic price and keep it there.

To prevent a slump arising from the premature restarting of uneconomic mines (those with a mining cost of say over £90 per ton of oxide) it would be well to have all mines under the scheme definitely figured up under output and cost. A condition of their receiving the allowance should be their undertaking to produce half their stipulated output within six months' notice, and the whole at twelve months' notice. If they cannot undertake this they should receive their dividend allowance only in proportion on the amount they do actually undertake.

When tin is at 10 per cent over the agreed averaged value, half the production from the reserve mines could be called up. When 20 per cent over its agreed value, all the reserve production could be called up and restrictions of any kind should cease. Under this scheme I doubt if there should be restraint on economic production at any time. The world can absorb all tin producible at a mining cost of £90 per ton of oxide or under.

The old-time tin producers of the Malay looked askance at all efforts to rationalize output. But a motivating force and a rallying point arose in the person of Mr. John Howeson, who, first setting himself to collect under one control many of the Malayan, Nigerian, and Cornish mines, later became the prime mover in the endeavor to adjust supply to demand. The movement has already (April, 1930) made remarkable

headway, and the recent manifesto of the Tin Producers' Association estimates a curtailment of the normal 1930 production by no less than 27,000 metric tons.

Such great success was scarcely anticipated by the industry, and even now many of us fear the burden of carrying the non-restricting proportion. But the efforts of the group responsible have not only largely overcome the prejudice and antipathy previously existing, they have resulted in inspiring into sympathetic co-operation producers of entirely diverse temperament, methods, and outlook. So long as the price of tin is prevented from soaring beyond that shown in my averaged safety line as essential for the production of the amount of tin needed by the industrial world, the Tin Producers' Association should be spared the fate attending efforts to maintain the price of a metal at above its economic production cost: the latter offers a safe mean, neither too high nor too low—one that will induce production of all that industry can carry and no more.

But, in any proposals for the reorganization of the industry, the men in charge must be those responsible for the production of the most tin at the least cost and not the reverse. With production in each district controlled or inspired by the men already proved most able, prices might even be lowered; or, without increase in price, a greater output of tin may be procurable to provide for the greater consumption suggested.

Tin is not like a crop that is replaceable annually. In Malaya one deals with the realization of a certain definite quantity. Once mined and sold nothing is left wherewith to replace capital. Shrewd men will see that they do not sacrifice what has been committed to them for realization at the greatest practicable profit.

A man who offers a sovereign for sale at 10/- may be regarded as a harmless lunatic, a sportsman with a bet on hand, or someone with more cash than sense. How, then, is one to consider an industry apparently willing to sell at £150 what it knows to cost much more to produce, and destined within six years to command a much higher price! Production in other commodities is limited to meet consumption, the latter accelerated by research, propaganda, and financial inducement. This lesson must be heeded in the production of tin.

The mining of tin has an advantage over that of the other base metals in that the price obtained for the extracted metal, as shown by the trend of the averaged price line, appreciates materially over a series of years in spite of temporary slumps. As a result, the Cornish and others with special experience of mining, notably the Australians, have invested in tin mining with tenacious persistence, though the "mining" may be only dredging, pumping, sluicing, or hydraulicking.

Further advantage is that the largest production comes from measureable detrital deposits. The lode mining of tin introduces an element of uncertainty. The Malayan check-bored detrital deposits are notably free from the uncertainties of lode mining. But the time comes in Malaya, as on the Witwatersrand, when the indifference of the speculator—there is but little "kick" in shares which the markets place on a sound investment basis—and the innocence of that type of investor who still classifies all mining as a gamble, cause less attention to be paid to certain shares than their merits as high-class investments deserve. It may be that such a time is the present.

On looking into my Malayan list, a great discrepancy will be noticed in the capitalization of the two groups of mines. Those producing at a mining cost of under £72 per ton of oxide have an issued capitalization of £254 per ton of oxide produced, whereas the higher-cost producers have an issued capitalization fo £433 per ton of oxide produced. Can it be that promoters in the latter group decided to make their profit off flotation rather than off production?

The careful investor who realizes that the world price for tin cannot remain forever at less than the cost of production will not have cause to regret the application today of Inman's tables and of the slide rule to certain tin undertakings, provided he arms himself beforehand with reliable knowledge from first-hand sources.

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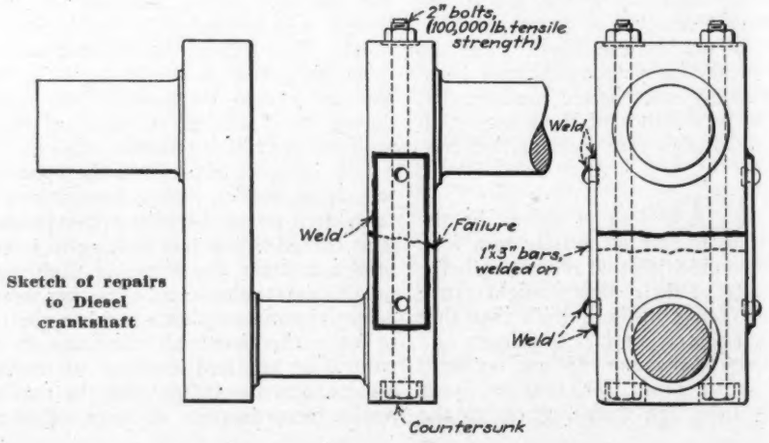
Crankshaft Rendered Serviceable by Novel Repair

AT THE Diesel power plant of the Morenci Branch of the Phelps Dodge Corporation, at Morenci, Ariz., considerable trouble was experienced with the crankshaft of a 1,000-hp. Diesel engine, according to R. M. McDougall, master mechanic. The failure, resulting from a flaw, occurred on the scavenger pump drive crank in the form of a crack extending through the right web, as illustrated in the accompanying sketch. With no spare shaft available, means had to be found to recondition the broken shaft in the least possible time and to place the Diesel unit again in service. This was successfully accomplished by first drilling two countersunk 2-in. diameter holes through the broken web and inserting and tightening two corresponding bolts made of special steel of 100,000 lb. per square inch tensile strength. Next, a tapered groove about 1½ in. wide, following the entire crack, was chiseled with the aid of a pneumatic hammer, and, after being thoroughly cleaned, welded by the arc-welding process. To insure additional strength and safety two short lengths of 1x3-in. bar, provided with two oval 1¼x1½-in. diameter holes, were welded onto the sides of the crank web, care being taken to first provisionally "spot" the bars to prevent deformation caused by the developed heat of the arc. The crankshaft when tested on the lathe was found to be about 3/32 in. untrue on the repaired crank end, which was remedied by rectifying the bearing stub with a thin cut on the lathe and providing a new set of bearings. The aforesaid Diesel engine has been in operation for some time since the repairs were made, and no further failure or trouble has been experienced.



Sketch of repairs to Diesel crankshaft

Resuscitating a Gold Mine in the Peruvian Andes

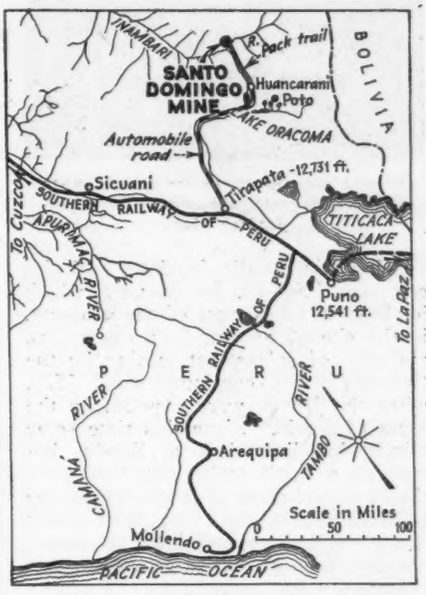
H. D. Keiser
Assistant Editor

Clarence Woods

TWO YEARS AGO, when his principals decided not to follow his recommendation to acquire the Santo Domingo mine, in Peru, Clarence Woods optioned the property himself. Continuous and successful operation of the mine has since followed, Mr. Woods recently purchasing the property from the former owner—the Inca Mining & Development Company. This name he has retained as the name of the present operating company, of which he is president and manager.

Many a property has been rejected by certain interests only to be later operated profitably by others. Such a turn in the history of the Santo Domingo mine would therefore not be considered unusual were it not for the fact that the achievement was accompanied by, or was, perhaps, the direct outgrowth of, remarkable human relationships. These prevail not only among the members of the operating staff, but also between the staff and the workers. In this instance, where the owner and the operating staff are foreigners and all the workers are Peruvian Indians, the development of such good will, accord, and co-operation has particular significance. Speaking of these conditions, Mr. Woods said that he attributed them primarily to fair dealing with the workmen at all times, and to permitting and encouraging his staff to participate financially in the enterprise. Other factors that he mentioned as contributing to the situation included the practice of total abstinence on the part of all members of the staff while at the property, and a policy strictly opposed to the offering of bribes.

Mr. Woods, who is a graduate of the Missouri School of Mines, went to South America in 1923, following more than fifteen years' experience as a mining engineer and mine superintendent in the United States, Alaska, and Central America. His first engagement in South America was as mine superintendent for the Huanchaca Company of Bolivia, at the company's Pulacaya property. In 1925 he was appointed general superintendent of the General Mines Company of Bolivia, in charge of operations at Chojñacota. This position he held until 1928, when he resigned to take an option on the Santo Domingo mine, in Peru. To this venture he has brought not only his extensive mining experience but also an enviable reputation in West Coast South American countries as an efficient and just mine operator.



Sketch map showing route to the Santo Domingo mine

The Santo Domingo mine is situated in the Province of Carabaya, 140 miles north of Tirapata (see accompanying sketch map), a small village on the Cuzco division of the Southern Railway of Peru. From Tirapata a hard-surfaced automobile road extends to Huancarani, 100 miles to the north. A 40-mile pack trail, most of which is cut out of solid rock, connects Huancarani with the mine. The first 34 miles of the trail is down the Quitun River to its junction with the Inambari River. In this distance the Quitun River is crossed seven times, each crossing being made by means of a suspension bridge of the type shown in one of the accompanying illustrations. The trail then follows Santo Domingo creek six miles to the mine, which lies near the summit of a ridge at an elevation of 5,750 ft. and in a region having a healthful climate.

The general store and some of the living quarters at the Santo Domingo property

This article is based largely on an interview with Mr. Clarence Woods that took place several weeks ago, while he was passing through New York en route to San Francisco.

From a short distance the dense timber almost conceals the Santo Domingo surface plant

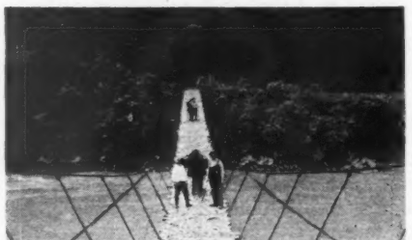
Mining in the district dates back for centuries. Sandia, for instance, which is about 40 miles west of the property, is the site of ancient Inca operations, and also of subsequent mining by the Spaniards that continued until 1770, when the Jesuits were expelled by the King of Spain. Since this time some mining has been done at Sandia, but only on a small scale. At Poto (see sketch map), about 50 miles south, the Spaniards at various times had placer operations; a general lack of water, however, has prevented continuous or extensive work there.

Valesquez, a Peruvian, discovered the Santo Domingo deposit in 1895 by following float up Santo Domingo creek, from a placer mining operation of his, until he encountered a landslide that exposed the vein. News of the discovery reached an American petroleum engineer then in the region, who inspected the strike and optioned the tract on which it was made. The Inca Mining Company was organized that same year to develop and operate the property, the monthly production from which soon ranged from 3,000 to 5,000 oz. of bullion, 970 fine. A reorganization in 1915 resulted in the company's name being changed to the Inca Mining & Development Company. Operations were continuous from 1895 to 1925, and for 25 years the property was the outstanding gold producer of Peru. The mine was shut down in 1925, owing to the depletion of high-grade ore reserves and to ore-treatment difficulties. Mr. Woods subsequently examined the property, optioning it in 1928, and recently purchasing the title to the entire holdings of the company.

Llamas bringing in mine supplies from Tirapata

The Santo Domingo deposit consists of a fissure vein, with which is associated a graphitic slate gouge that varies from a few inches to more than 10 ft. in width. Along this gouge, usually on the footwall, are the ore-shoots. These range in width from 3 to 20 ft. The ore consists of: (1) free gold, iron pyrite, arsenical pyrite, and antimony (stibnite) in a quartz gangue; (2) free gold in the graphitic slate gouge; and (3) gold combined with the sulphides in the quartz.

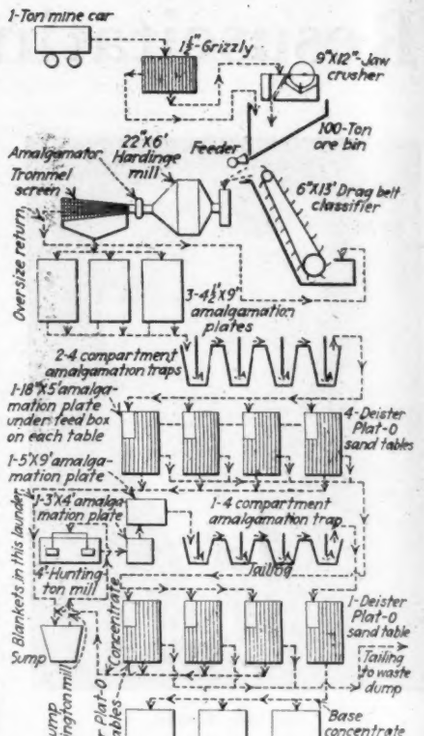
As Mr. Woods has explained in a previous article[1], the free gold is recovered by amalgamation, the combined gold being segregated in a concentrate. This concentrate, which averages 5 oz. of gold per ton, has been stored for future treatment. In the course of earlier operations, various attempts had been made to treat the ore by the cyanide process, but these were all unsuccessful.



One of the suspension bridges across the Quitun River

When the property was acquired by Mr. Woods in 1928, he estimated the ore reserves at about 1,000 tons; in addition, 1,300 tons of concentrate was available. Since then ore reserves have been expanded materially by systematic development, and milling operations have increased the concentrate reserve to 3,000 tons. At present about 70 tons of ore is being treated daily, power being obtained from a 270-hp. hydro-electric plant on the property.

Plans are now being completed by Mr. Woods, while on a visit to the United States, to mill 150 tons of ore daily at the property instead of 70 tons, and to treat the concentrate that has been accumulated. The milling of a larger tonnage will involve the utilization of a new 540-hp. hydro-electric power plant, the construction of which is nearly finished. A roasting plant producing 15 tons of calcine a day will be erected to treat the concentrate. A MacDougal-type furnace will be employed, the calcines being ground in a Marcy mill and then cyanided for recovery of the gold.



Flow sheet of amalgamation plant

The operating staff of the company comprises: Clarence Woods, manager; J. A. Othick, mill superintendent; William Maycumber, metallurgical engineer; F. A. Stackpoole, mine superintendent; Y. Muto, electrical engineer; Clarence L. Woods, mining engineer and assistant manager.

A portion of the pack trail between Huancarani and the mine

[1] "Profitable Amalgamation," by Clarence Woods; *Engineering and Mining Journal*, April 7, 1930; Vol. 129, No. 7, pp. 356.

Secondary Enrichment at Cananea

Morris J. Elsing

Formerly Superintendent of Mines and Chief Geologist, Cananea Consolidated Copper Company

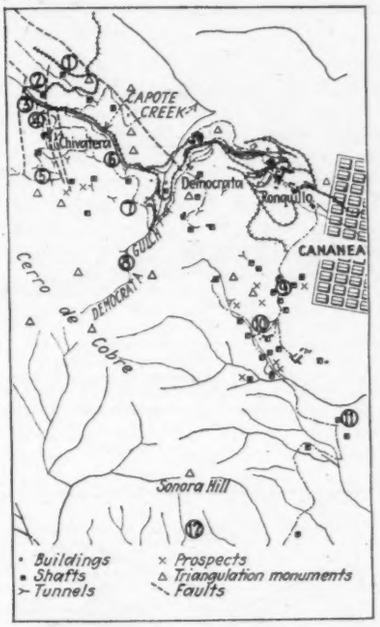
IF CERTAIN definite geological facts can be established which are valuable as guides for prospecting, mining geology proves its worth to the industry. A narrow interpretation of facts and the formulating of theories not based on a tremendous preponderance of evidence in their favor are dangerous and extremely unwise. The province of the geologist is to study the conditions under which ore exists, and with this knowledge as a basis to search for similar conditions with the expectation that like conditions will give like results. The habits of orebodies are usually so erratic that it is not often possible to make, with assurance, definite predictions as to their behavior. This discussion of secondary enrichment at Cananea is presented as an instance where I believe prediction can be made with considerable assurance. In this particular case, the conclusions reached agree with the generally accepted theories of secondary enrichment, and, therefore, they afford an additional reason for being regarded as reliable and trustworthy.

The following discussion is in no way a treatise on secondary enrichment at Cananea. The evidence presented is merely a statement of facts regarding the elevation of the zones of secondary enrichment with relation to the elevation of the gulch or drainage level nearest to the enrichment. From this relationship definite conclusions are drawn.

The greater part of the copper in the Campana, Sierra de Cobre, Capote No. 2, Oversight, Chivatera, Veta Grande, Cobre Grande, and Bonanza mines occurred as secondary chalcocite. This is likewise true of the "churn-drill areas" in the Democrata Gulch and at Sonora Hill. Secondary enrichment above the 200 level of the Cananea Duluth has been an important factor in determining the grade. The ores at the Puertocitos, Elisa, Capote No. 15, Kirk, Democrata, and Colorada mines are mainly primary and do not enter this discussion.

Reference to the accompanying map of the district will show that Capote Creek flows in a general easterly direction. At the westerly end, the Sierra de Cobre and the Campana mines lie north of the creek. At this point immediately south of the creek are the Capote and Oversight mines. A little farther east and on the southerly edge of the creek is the Chivatera mine. Still farther east is the Veta Grande mine. The Democrata Gulch churn-drill area is in the Democrata Gulch, which is a southerly branch of the Capote Creek. At the Veta Grande mine the Capote Creek turns north, where it has a steeper gradient than in the part already described. Cobre Grande Creek also flows in a generally west-east direction. The Bonanza mine is immediately north of the creek and the Cananea Duluth is south of it at a point about three-quarters of a mile east of the Bonanza. The area near the Cobre Grande mine is drained by a branch of the Cobre Grande Creek.

Water does not flow in the Cobre Grande or the Capote creeks except during and after the rainy season and after storms. Water flows in the Capote for a considerably longer time, as it drains a larger area than the Cobre Grande Creek.



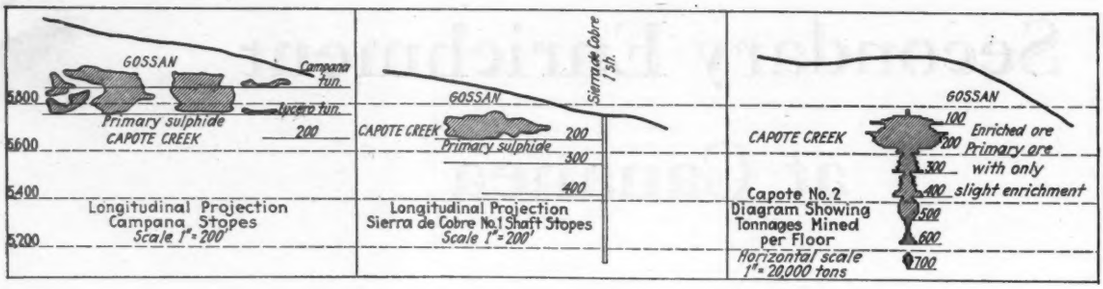
Sketch map of Cananea district, Sonora, Mexico, showing location of following mines: 1, Campana; 2, Sierra de Cobre; 3, Capote; 4, Oversight; 5, Southwest Oversight; 6, Chivatera; 7, Veta Grande; 8, Democrata churn-drill area; 9, Cobre Grande; 10, Bonanza; 11, Cananea Duluth; 12, Sonora Hill churn-drill area.

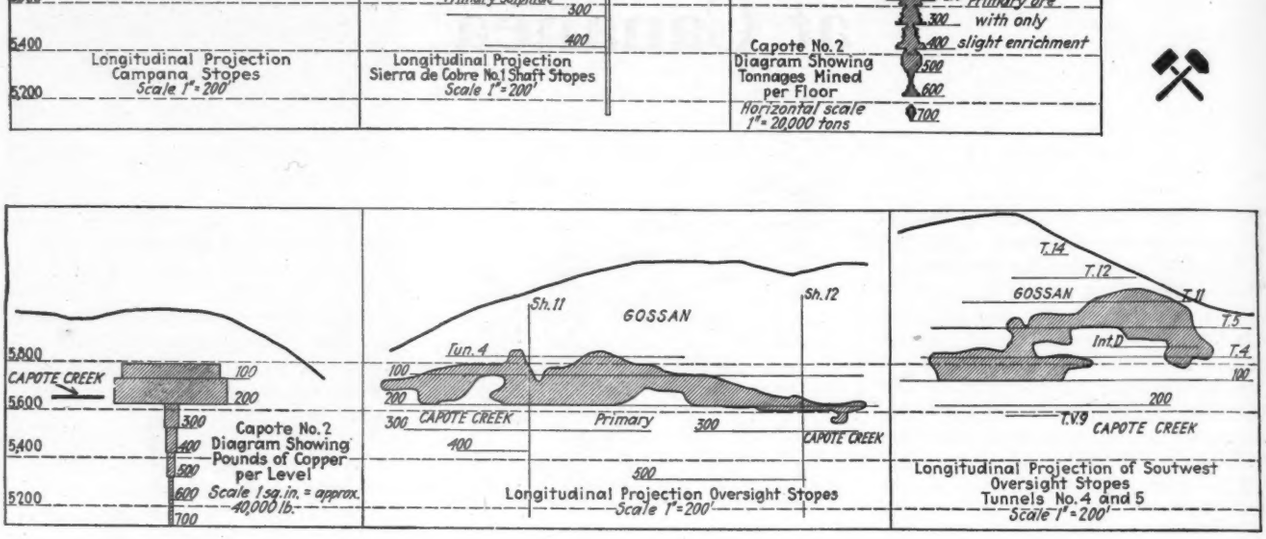
A cross-section of each of the secondary ore deposits at Cananea is shown on the following page. A brief description of the ore represented in these sections is also given.

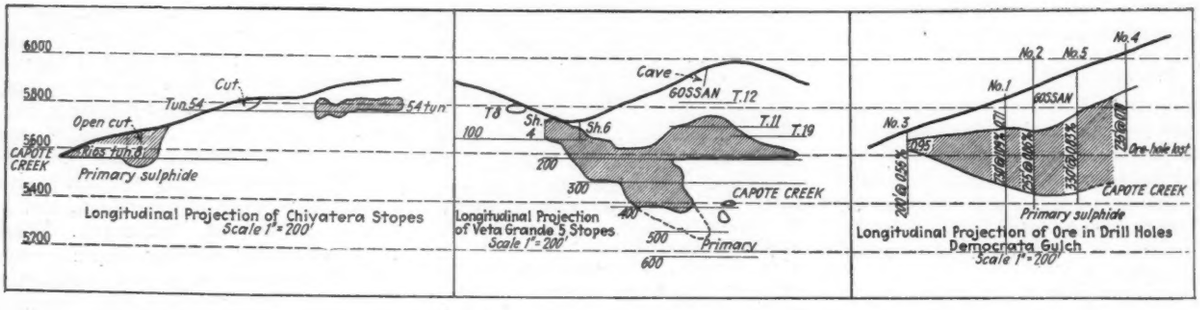
Campana Mine — Most of the ore mined from the Campana was azurite and malachite with some red oxide in a gangue of silica and iron oxide with some manganese. There were two or three stopes of high-grade chalcocite, containing both the steel and the sooty variety. At the surface a small amount of high-grade cerussite was mined. The ore occurred in limestone and also in a siliceous contact breccia near a limestone-diorite and quartz-porphyry contact. The Lucero Tunnel level was almost at the bottom of the zone of secondary enrichment. Low-grade pyritic material goes below the tunnel, and in one place there is a little galena. Work at considerably greater depth shows pyritic material with an occasional bunch of chalcopyrite and bornite. Capote Creek is about 100 ft. below the bottom of enrichment and is approximately 1,200 ft. south of the center of the orebodies.

Sierra de Cobre No. 1—This orebody was composed entirely of sooty chalcocite and pyrite. In some places at the top of it very high-grade chalcocite was overlain by 2 to 4 ft. of sandy, barren pyrite, which in turn was overlain by siliceous iron-stained gossan. This high-grade ore occurred entirely above the 200 level. A root of primary pyrite occurred on the 200 level and below. In places it contained sufficient chalcopyrite and bornite to warrant stoping, but the amount stoped was comparatively small and very erratic, both as to shape and grade. The ore occurred in limestone in the hanging wall of the Ricketts Fault zone, the footwall of which is quartzite. Capote Creek is 400 ft. north of the orebody, and the bottom of secondary ore has the same elevation as the Creek.

Capote No. 2—Capote No. 2 mine has produced both secondary and primary ores. For this discussion a diagram of the ore down to the 700 level only is shown. The rich chalcocite ores rapidly diminish at the 200 level. Below this level enrichment did





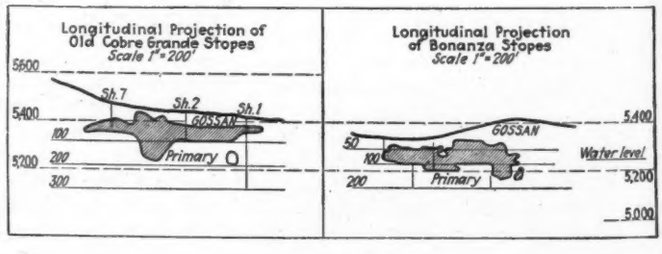


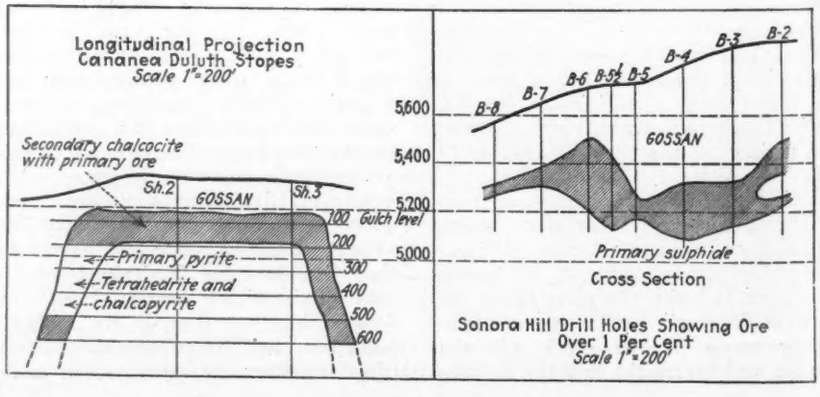
not disappear, but the presence of primary ore became the important part of the mineralization. A minor amount of chalcocite was present as deep as the 1,000 level. On the 900 level there was sufficient chalcocite coating on pyrite in quartzite to make a satisfactory converter silica running 1 per cent copper. However, the amount of ore in the form of chalcocite was comparatively small below the 200 level as compared with the bonanza chalcocite stopes of the 100 and 200 levels. Two diagrams of the direct-smelting ore mined in the early days are shown. One shows the tonnage mined per stope floor and the other the approximate amount of copper produced per level. Neither diagram shows the entire production of the Capote No. 2 to the 700 level.

Undercutting and caving methods of mining adopted at the Capote No. 15 mine were extended to the lower levels of the Capote No. 2. These orebodies are connected and are continuous. The caving operations have produced considerable tonnages that were drawn from below the 700 level of the Capote No. 2. Therefore the diagrams are not true representations of the total ton-

Sketches indicating the relationship of ore deposition at Cananea to Capote Creek

Note—The position of the words "Capote Creek" on the drawings indicates the approximately elevation of the creek.





nages produced in the entire history of production. The exact amount of this low-grade concentrating ore cannot be obtained, as it became a part of the Capote 15 production. Its amount does not have a bearing on the question of secondary enrichment, for the reason that the ore was mostly primary ore. The important consideration is the fact that the 200 level marks the lower limit of high-grade enriched ore.

The geology of the deposit is very complicated. For this discussion it is sufficient to say that the orebody was an irregular pipe occurring in its uppermost portion in limestone. At the 700 level the pipe extended into the quartzite and then changed its direction and shape, passing into intrusive granite underlying the quartzite.

The bottom of the secondary portion of the Capote 2 was cut by a tunnel from the bottom of Capote Creek, and it lies about 400 ft. south of the Creek.

Oversight—There are two main divisions of the Oversight mine. These are distinguished as the Oversight and Southwest Oversight. In the Oversight, ore has been mined continuously for a distance more than 2,000 ft. in length. The ore from this section was almost entirely secondarily enriched cupriferous pyrite, the primary pyrite below enrichment running 0.2 to 0.5 per cent copper. Below the 200 level in one or two small stopes a little chalcopyrite and bornite were stoped. The longitudinal projection of the Oversight stopes shows that the ore bears no relation to the surface elevation. At the northerly end of the mine the overburden is less than 100 ft. deep, whereas at the southerly end it is 500 ft. On the other hand, the bottom of the enrichment is more or less constant and dips gently to the south, having about the gradient of the Capote Creek, with which it is roughly parallel.

The ore occurs in limestone along a fault contact zone with quartzite, which zone is 800 or 900 ft. from the Capote Creek, and the bottom of the enrichment is 50 to 60 ft. above the creek level.

The fact that 500 ft. of gossan material lies over the ore on the south end does not imply that there is more ore here or that the grade is higher. It might be well to mention that the depth of general oxidation has descended perhaps only 100 ft. below the surface. For example, if a crosscut tunnel were run at an elevation of 200 to 300 ft. above the southern end of the Oversight orebody, the following conditions would be encountered: Passing through a zone of shallow oxidation from 25 to 100 ft. in thickness, sulphide would be cut. At this contact a slight but not commercial enrichment would be found. The tunnel would then pass through unoxidized ground until the main gossan zone was met, with its orebody 200 or 300 ft. below. This zone having been passed, unoxidized sulphides would again be found in the tunnel. In other words, oxidation as deep as the creek level obtains only in definite strong shear zones or along certain favorable contacts. It is true that the areas between these points contain less primary values than the favorable zones, but, nevertheless, in many places they contain sufficient values to warrant the assumption that under proper conditions for enrichment, orebodies would have resulted.

Southwest Oversight—In this section of the mine, ore occurs in the limestone and in the diorite with which it forms a contact. Several small azurite-malachite orebodies are found wholly in the limestone, but the main production came from chalcocite ore which occurred in the diorite and in completely altered and kaolinized limestone near the diorite contact. This ore occurred at a distance of about 1,200 ft. from Capote Creek, and the bottom of enrichment was about 160 ft. above the Creek level.

Chivatera—This mine has produced large tonnages of oxidized lead ore mined mainly for its silver content. Below this oxidized ore there was a bed of high-grade chalcocite, which at a slightly greater depth turned into chalcopyrite and bornite, and, at a few feet below the Rios Tunnel, gave way to low-grade pyritic ore containing occasional bunches of chalcopyrite and galena. The Chivatera orebody occurred a few feet south of the creek and the bottom of enrichment coincided with the creek elevation.

Higher up the hill and away from the creek, surface cuts produced several thousand tons of oxidized zinc ore, which at shallow depth gave way to zinc blende and pyrite. In tunnel 54, high-grade oxidized copper ore and copper glance were produced, but at these points conditions were not favorable for oxidation to levels as deep as the Capote Creek.

The ore at the Chivatera mine occurred wholly in shear zones in the limestone.

Veta Grande — The orebody at this mine comprised a large mass of completely enriched chalcocite ore extending to the 500 level. As in the case of the Oversight, oxidation, outside of the main zone, extended downward to a point only a few feet from the surface.

The elevation of Capote Creek indicated on each of the already described sections was taken at the nearest point to the mine. In the case of the Veta Grande, it was taken at the easterly point. The Veta Grande orebody occurs near the junction of the Democrata Gulch and the Capote Creek. At this point the Capote Creek makes almost a right angle bend and flows north. The elevation indicated gives the elevation of the creek about 1,600 ft. from the mine. Beyond this point the creek drops down rapidly and in a short distance attains almost the elevation of the bottom of the Veta Grande enrichment. The Veta Grande ore occurs in a shear zone in limestone and diorite. On the 500 level the ore is quite pyritic and carries some zinc blende.

Democrata Gulch Churn-Drill Area —The low-grade ore in this area consists of partly enriched pyrite occurring both as stringers and as disseminated specks and particles through the diorite. All of it occurs above the Capote Creek level.

Cobre Grande and Bonanza Mines—The ore from these mines included cuprite, malachite, and chalcocite. Enrichment became less below the 100 level and did not reach the 200 level. The elevation of the Cobre Grande Creek a few hundred feet from the mine coincides with the elevation of the bottom of the secondary ore.

Similar conditions existed at the Bonanza mine, which near the surface was productive of small tonnages of very nice chalcocite ore, but at comparatively shallow depth it gave way to pyritic material.

Sonora Hill Churn-Drill Area — A considerable tonnage of ore averaging better than 1 per cent copper has been indicated in this section. This ore occurs in diorite and quartz porphyry. It, too, occurs above the drainage level of the area immediately adjoining it.

Cananea Duluth — The ore at the Cananea Duluth is mainly primary. Secondary enrichment has played its part in the upper levels, but when a depth is attained a short distance below the general drainage area, most of the secondary values disappear.

Comparative Elevations, Bottom of Enrichment and Capote Creek

Mine	Elevation Bottom of Enrichment, Feet	Elevation Capote Creek, Feet	Distance Above or Below Creek + or—
Campana.....	5,750	5,650	+100
Sierra de Cobre	5,650	5,650	0
Capote No. 2..	5,620	5,630	— 10
Oversight			
North End..	5,625	5,550	+ 75
South End..	5,550	5,500	+ 50
S. W. Oversight	5,710	5,550	+160
Chivatera.....	5,550	5,550	0
Veta Grande...	5,280	5,425	—145
Democrata Gulch Drill Area.....	5,440	5,450	— 10

As shown by the tabulation the Veta Grande ore is the only secondary ore that goes for any appreciable distance below the level of the Capote Creek. The reason for this has already been suggested. From the orebody to the creek is about 1,600 ft. At a point 2,400 ft. farther down the creek the elevation of the creek bottom coincides with the bottom of enrichment.

The cross-sections herewith presented do not show all of the enriched orebodies in Cananea. Many smaller deposits are found, but in each case they exhibit the same characteristic of passing into primary ore at more or less the same elevations as depicted by

these sections. There are no exceptions to the rule. Furthermore, the deeper development done in the exploration of the primary ore deposits nowhere shows leached oxidized areas.

Enrichment with respect to the present underground water level furnishes an interesting subject for study. However, to establish exact data on underground water levels for the different mines is difficult. Shafts in the various parts of the camp were sunk at different times. The water pumped from the first shaft sunk would naturally drain a certain area in its vicinity, and a subsequent shaft sunk in a partly drained area would encounter water below its normal level. Then, too, a shaft is usually located in an area least broken or decomposed, and the point at which water is encountered might not be the true water level of the area involved.

Based on all available data, one may safely say that the underground level before it was changed by pumping was much nearer a horizontal plane than the bottom of enrichment. In the vicinity of the Capote mine it was probably about 200 ft. below the Capote Creek, and at the Veta Grande it was perhaps 75 ft. below the creek level. At the Cobre Grande and Bonanza mines, it was only slightly below the drainage level. Comparing the relation of the present water level with the bottom of enrichment one may say that in the vicinity of the Capote it was about 200 ft. below the bottom of enrichment; at the Veta Grande these levels coincided; and at the Cobre Grande and Bonanza the water level partly covered the enriched ore.

In conclusion, the conservative statement can be made that 90 per cent of the secondarily enriched ore of the Capote basin area has been produced above the elevation of the Capote Creek level; also, that the bottom of enrichment closely follows the gradient of the creek. A less important conclusion is the fact that the bottom of enrichment, as distance north or south of the creek is obtained, attains a higher level above the creek. I may also state that no secondary ore exists below the creek level which did not have its most extensive occurrence and its richest content above the creek. Topographic features other than the creek elevation play no part in the amount of ore or its grade.

Rock formations evidently have only a minor influence on enrichment. Azurite, malachite, and the red oxides of copper occur in the less altered, fresher limestone and marble, which is as it should be. The chalcocite ore occurs in altered decomposed limestone, diorite, and quartzite. Structural features as represented by faults and shear and breccia zones are of much more importance than the character of the rock formations, both because they permitted the entrance of the ore-forming solutions and the subsequent enrichment which produced the orebodies.

Post-enrichment faulting has not been effective in disturbing the general continuity of the elevation of enrichment.

Study of this subject was originally undertaken in the endeavor to establish as much data as possible which would guide the exploration work efficiently in the search for additional secondary ore. Obviously, the results establish the fact that a search for secondary ore below the elevation of the Capote Creek level is futile. This, of course, does not apply to primary ore. The second important conclusion developed is that the most favorable area is an area of brecciation or shearing.

If exploration is undertaken by drifting or tunneling, it is much safer to work high than low. If the work is too low, one may pass under ore without finding it. On the other hand, if the work is too high, the ore may not actually be discovered, but at least the work will be in the gossan area, which will quickly lead to the orebody.

Similar conclusions are drawn for the areas in the vicinity of the Cobre Grande and Bonanza mines. In these the country is rolling rather than mountainous and the gradients of the creeks are much less steep than the Capote Creek. Enriched ore is found near the surface, but it does not have a great vertical range.

In conclusion, the data presented permit one to pick out in each section of the district a more or less definite vertical range in which secondary enrichment may exist. The range of the elevations within which secondary orebodies occur is shown for each mine in the following table:

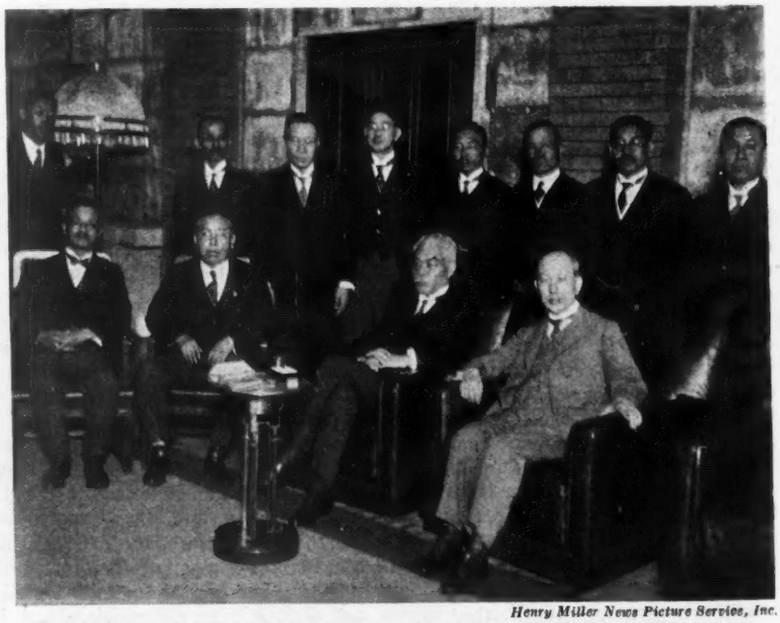
Mine	Elevation, Feet
Campana	5,750—5,950
Sierra de Cobre	5,650—5,800
Capote	5,600—5,800
Oversight	5,600—5,800
Oversight, S. W.	5,750—6,050
Chivatera	5,550—5,750
Veta Grande	5,400—5,750
Democrata Gulch	5,450—5,800
Cobre Grande	5,250—5,400
Bonanza	5,150—5,325
Cananea Duluth	5,050—5,200
Sonora Hill	5,100—5,400

By basing conclusions on this table, the local topography, and the structural features, one can select a vertical range in areas adjacent to these mines which is the most likely to be productive. In many cases this favorable vertical zone can be defined as existing within 100 ft. vertically. A maximum vertical range would be 200 ft. Ore might occur above or below these ranges, but for each given area there is a vertical zone of from 100 to 200 ft. which is more favorable for development than any other zone.

In areas beyond those already developed or partly developed, the criteria for selecting the most favorable vertical zone are perhaps a little less accurate. In these areas, the adjacent drainage levels and structural features determine the most favorable elevations.

In addition to the secondary orebodies described, other smaller secondary deposits occur. In some of these enrichment has not progressed far enough to produce commercial ore, but in every case they exhibit the same characteristic of being limited in depth by the drainage level near which they occur.

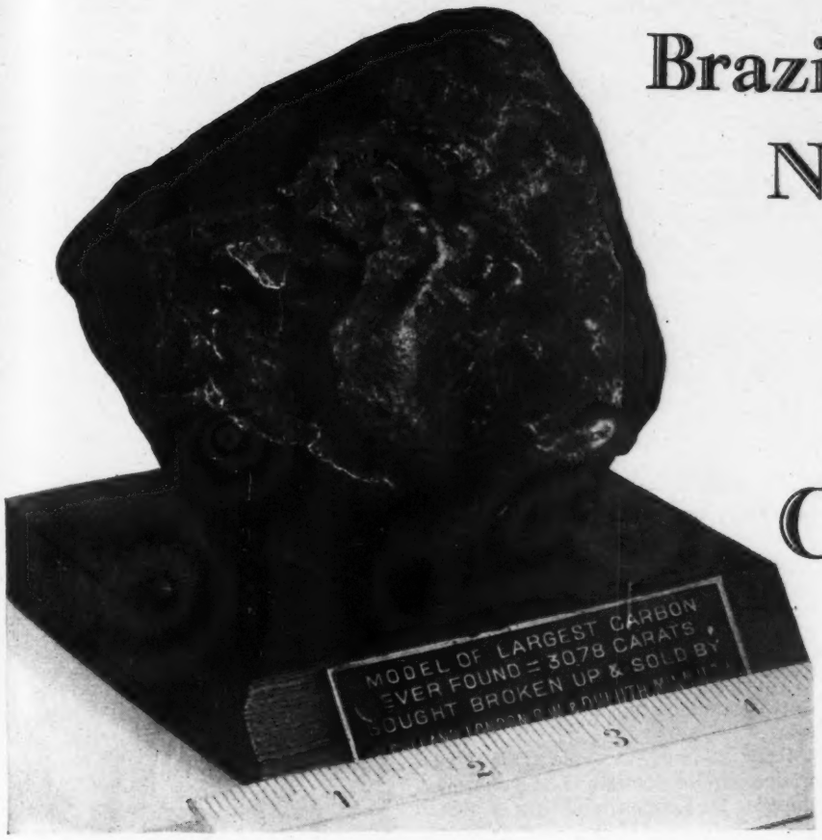
Japanese Mining Inspectors in Conference



Henry Miller News Picture Service, Inc.

Third from left (seated) Premier Hamaguchi and on his right the Minister of Commerce, photographed with local mining inspectors when they were invited to his official residence for tea, after attending a conference held at the Department of Commerce and Industry, Tokyo, Japan, at which they discussed the mining affairs of the country.

Brazil's Natural Monopoly: The Carbonado



Actual size of largest diamond ever found

W. N. P. Reed
Assistant Editor

CONCENTRATION of wealth has attained the ultimate in nature's own product—the crystalline diamond of first-water quality. Africa is by far the largest producer of white diamonds, but, in the opinion of some experts, Brazil leads the world in the production of white stones of the most perfect brilliance. Whether South Africa, India, or Brazil be entitled to first rank as a producer of diamonds of first-water brilliance, the last-named country enjoys the distinction of possessing the only known commercial deposits of the carbonado, a so-called anthracite variety of diamond, opaque, massive, occurring usually as rounded irregular polyhedral forms with radiated and confused crystalline and slightly cellular structure. The stones are dark gray to black in shade. The highest specific gravity of a black diamond is slightly less than that of the white stone, which varies only slightly and is generally about 3.50.

Three varieties of diamonds are known: the crystalline gem stone, which may be polished to a brilliant radiance and which occurs, rarely, in many beautiful tints, as well as in crystal white, or, more rarely still, as a black gem; the bort or boort, frequently translucent and resembling the carbonado in structure; and the true carbonado. In some districts, all diamonds not crystalline are classified as bort.

Until the invention of the Leschot diamond drill, carbonados were of little value, but so rapidly has a use for them developed, that deep exploration by drills in which the diamonds are mounted in steel crowns, or "shoes," or bits (to afford variety in terminology) would in present practice be impracticable without them. Prospecting by the use of the diamond drill is now approved engineering everywhere. Carbonados have no cleavage, and are thus much better than crystalline diamonds for use in drills. In fact, the carbonado possesses the distinction of being the toughest substance on earth. The black diamond is exclusively utilitarian. Its function, in common with that of the ideal citizen as described by the immortal Theodore Roosevelt, is "to spend and be spent." Literally, the stones are ground to powder in the service of industry.

The largest diamond ever found was a carbonado. It was discovered in the State of Bahia, Brazil, in 1895.[1] The stone weighed 3,078 carats, and was worth at the present market more than $300,000. This carbon, broken to sizes suitable for use in diamond drills, rendered great service in the exploration of the Mesabi range. Beside this giant stone, the Great Mogul and the Koh-I-Noor rate low in the scale, as to size, among the famous diamonds of history.

Although diamonds of the crystalline variety were mined in Brazil as early as 1725, only since 1876 have carbonados been known in that great country, which possesses an area of 3,270,000 square miles. The presence of white diamonds in the Piranhas region of Bahia was discovered in that year by a miner named Lima. At that time the black diamond was considered of no value. In placer diamond mining, which was then done with slave labor, the carbons were discarded as waste material. Diamonds are known to occur in Brazil in other states besides Bahia: Paraná, São Paulo, Minas Geraes, Goyaz, Matto Grosso, Moranhão, and Amazonas. Carbons have also been found in the river beds of Goyaz and Minas Geraes, according to an official government report.

For more than fifty years the diamond operations of the Piranhas region were conducted by the most ancient methods. Exposed areas of diamond-bearing placer ground were worked out years ago, and the native miners had perfected a crude method of reaching the buried bedrock of the ancient rivers long before the introduction of machinery. First, the old river bed in which the stones were concentrated was located by the presence of Jatoba and Goncalo Alves trees, which thrive on the top of the prehistoric water courses. The miners then remove the overburden of clay, mud, and sand by filling their carumbes (small wooden bowls about 1½ ft. in diameter), placing them on

[1] "Mineralogy." Kraus and Hunt. McGraw-Hill Book Company, 1920. P. 192. Also J. K. Gulland, of London, England, and Duluth, Minn. (Note halftone above, which reproduces a model in exact size of the stone mentioned.)

Brazilian native diamond miners removing overburden by hand (and head)

their heads, and dumping the material some distance away. This operation is pictured in an accompanying halftone. After they reached the cascalho (diamond-bearing gravel) they removed the gravel in the same way, piling it on the river banks, where both men and women picked out the larger stones. The remaining material was taken back to the river, washed, and finally concentrated in bateas by whirling them on the surface of the water, a process that concentrated the final residue by throwing out by centrifugal force all but the carbonados and other material of higher specific gravity than the accompanying mass of gangue.

The carbonados range from minute fragments up to several hundred carats. Stones more than 10 carats in weight are broken up into commercial sizes. About 98 per cent of the product is used in drills, the remainder, in the form of 300-mesh powder, being used as a polishing material in the cutting of white diamonds and for abrasive purposes.

White diamonds concentrate easily because of their high and uniform specific gravity, and the African white diamond will stick to a greased table, but the white diamonds of Brazil will not to stick to such a table, owing to the fact that they are covered by a film. The gravel in which the carbonados occur is frequently about as heavy as the carbonados.

In a technical sense carbonados are not "dressed." Stones of larger than commercial size are split and broken under pressure by a sharp wedge of superhardened steel of German manufacture. After this simple process the carbonado becomes a very useful engineering tool, of such weights as the purchaser may specify, the price of which has varied from 25c. a carat sixty years ago up to $185 in recent years.

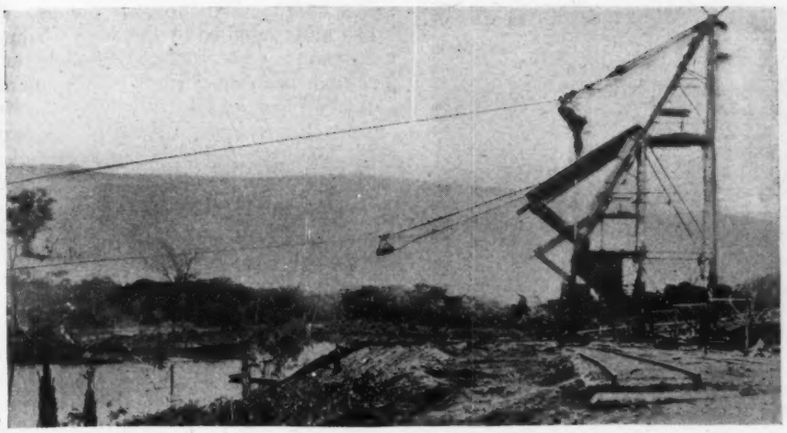
Prior to the War, the bulk of the production of Brazilian carbon was shipped to London and Paris, which were the main, if not only, sources of supply for industries using this material. During the period from 1914 to 1918, buyers from the United States established offices in Bahia, since which time the competition for the supply has been keen, as London, Paris, and New Amsterdam firms re-established commercial contacts in Bahia soon after the signing of the Versailles treaty.

In 1924, Arthur S. Bandler, of Bernard Bandler & Sons, Inc., of New York, for many years leading importers of industrial diamonds, went to the Piranhas region, in Bahia, to investigate the possibilities of mining carbonados on a large scale by modern mechanical methods. Bahia possesses the unusual distinction of being built on two levels at the foot and top of a tall cliff, and the city has installed two American elevators for the 10,000 daily up-and-down commuters. Mr. Bandler found conditions favorable for development. Though transportation facilities to the diggings were lacking for a difficult stretch of country, the laws of Brazil were and still are both reasonable and equitable—in fact, according to Mr. Bandler, nowhere in the world are property rights more rigidly respected. Furthermore, armored transport of shipments of diamonds was not necessary, as in most cities of the United States under existing conditions. Native labor was efficient and contented. Though much of the country had a bad reputation for fever, Mr. Bandler believed that modern scientific sanitary measures could ameliorate this condition. The Piranhas region is mostly tropical jungle and swamp. Snakes and insects abound. But even an anaconda boa constrictor 30 ft. long (a giboia) or a big sucuriú is only a snake, not poisonous, and destined, if not wary, to become,

Native diamond miners with primitive sieves and batea

as to its hide, my lady's footwear. Small lizards are constantly on safari—on walls, ceilings, and window panes, their prey being moths, flies, and other insects, on occasion, not to be mentioned in polite typography. At night these lizards, according to a recent report, prefer a ménu of lightning bugs, which, as they are stowed away in the bellies of the tiny reptiles, give forth subdued illumination from within the thin-membraned bodies—a weird and glimmering spectacle which may be enhanced and expanded in effect by a few hookers of cachaca (a rum made from sugar cane), which possesses a "kick" equal (here, again, according to report) to that of more sophisticated distillations. As to the functioning of the light-producing apparatus of the fireflys under the conditions described. a check-up by an

A section of the Bahia Corporation operations on the Paraguassu River, State of Bahia, Brazil



Two slackline cableways with 80-ft. movable head towers strip overburden and recover the diamond-bearing gravel

entomologist is not invited or desired.

"Prior to 1870," said Mr. Bandler, "when they were cutting Brazilian rough diamonds in Amsterdam, which was before the African productions came on the market, one of the Bahia cor-

Transporting 1½-yd. bucket by canoe

respondents of the diamond merchants in Amsterdam sent over some black stones from Bahia which he thought had diamond indications. Among these was a large black stone, of some 2,000 carats, used as a counterweight on a door. One of the diamond workers, having difficulty in polishing the facets of a white diamond, said one day to a fellow workman: 'I'm going to try a piece of this big black stone.' He split off a corner, powdered it, and found that it was better than white diamond powder. In those days, the carbonados, shipped in small kegs, brought 25c. per carat. Now the stones are used to extract cores as small as a broom handle or as large as a marble column. Perhaps as many diamond drills are now in operation in New York City as in any mining region in the world."

After his return to the United States, Mr. Bandler and his associates in the enterprise organized, in 1927, the Bahia Corporation, which owns all of the common stock of Bernard Bandler & Sons, Inc., of 8 West 40th St., New York City, which last-named company purchases and markets all the diamonds produced by the Bahia Corporation. Though natural obstacles had proved insurmountable to several previous attempts to work the diamond-bearing gravels of the Paraguassu River by large-scale methods, Mr. Bandler decided that modern machinery would solve the problem if complemented by the best engineering and sanitary practice. Therefore, as a preliminary to development, the Bahia company management sought and obtained the professional assistance of two mining engineers of long and successful experience, Alexander P. Rogers, and A. D. Hughes, the latter of whom is in charge of operations at the property, and who also acts as general manager of the Brazilian subsidiary of the Bahia Corporation, the Companhia Brasileria Exploracao Diamancina.

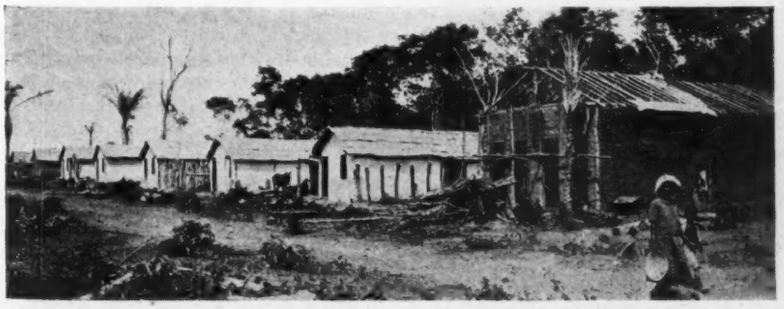
A quantity of the stones were brought to the United States, where a series of tests and experiments were conducted to decide on the best method of working the Bahia deposit. The engineers finally decided to use Sauerman power scrapers. To obviate any possibility of the drowning out by flood, the towers, when erected, were protected by deadhead cables, to which they were anchored as shown in the illustration on this page. The Bahia Corporation has a 30-year concession from the government of the State of Bahia, which with additional property it has acquired, gives it about 14½ miles along the Paraguassu River. This, together with a ranch of 25,000 acres, assures a permanence of opportunity for operation.

The property of the corporation is at Moreno, 250 miles due west from Bahia and 35 miles from the railroad. The land embraced in the concession was selected after a survey. It is just east of a range of mountains running north and south, and the terrain is composed mainly of sedimentaries. The carbon in the concession apparently originated from volcanic sources connected with the Lavras series, uplifted into mountains. Rising in these mountains the Paraguassu River flows eastward through the flats. The stream

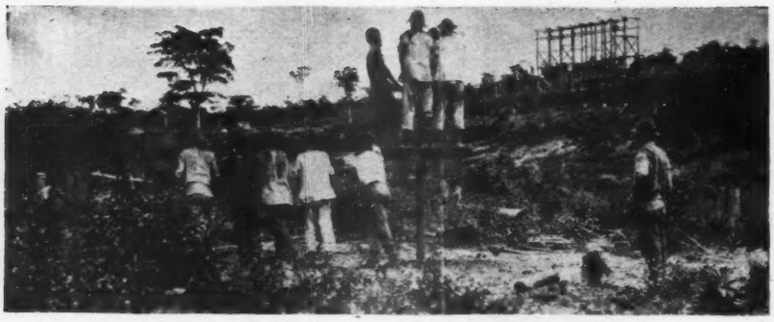
Cableway 1½-yd. bucket in action

finally unites in a flat or placer of about twenty miles in extent, which acts as a catch basin. The river enlarges from a width of about 200 ft., until near its mouth it is more than 1,000 ft. wide. It finally flows into Bahia Bay, where it is 2,000 ft. wide. Through the action of the stream, a gravel deposit resulted, sometimes indurated and sometimes not.

To get to the property, when the concession was obtained, it was necessary to take a steamer and cross the bay from Bahia, and thence to proceed up the Paraguassu River to the town of Cachoeira. From Cachoeira one crosses



The new village erected for native workers by the Bahia Corporation at Moreno



Drilling ground at Moreno to identify diamond-bearing stratum

the river in ajojos (large canoes made from the trunks of trees) to the town of San Felix, the railroad terminus, which is operated by a French company. A ride of twelve hours takes one to Itaete, and from Itaete the trip was formerly made by a mule trail, and after a long day's ride the traveler reached the Piranhas black diamond district. The Bahia Corporation has now completed a road suitable for auto traffic over this bad stretch of the route.

The placers of the Piranhas region are being continuously enriched by carbons and white diamonds washed down from the mountains. The country is at the 100 meridian and 13 deg. south of the equator. Its climate is fever-ridden in most places not drained and brought under sanitary control. Expert labor was hard to get, but a Brazilian doctor from the Rockefeller Foundation drained the lagoons and pools, and made the place salubrious.

Operations required hauling practically 1,000 tons of freight to the site of the mining concession. The shipment is first taken by a sailing barge 50 miles up the river, then 160 miles by rail, and the last 40 miles again by river, the heavier pieces being transported by loading two canoes together. In bringing in the preliminary plant installation, all were conducted up the stream by hand labor without mishap.

Black diamonds occur mixed with wash and gravel and are hard to identify. As the deposit containing the stones consists of loose gravel on a limestone bedrock, with 15 to 20 ft. of pure sand as an overburden, the problem of mining is divided into two phases: the removal of the overburden first, and the later separation of the sand and carbon-bearing gravel. For the removal of the overburden, two 1½-yd. Sauerman slackline cableways, reaching several hundred feet on each side of the river for a total span of 900 ft., are used. Each machine has an 80-ft. movable steel head tower, moving on rails parallel to the river bank, carrying not only the cableway equipment but also a large hopper, so that when digging gravel the cableway bucket discharges directly into this hopper and the gravel is loaded into cars spotted below the tower. The company in the early stage of development contracted for the shipment of a plant, which installation consists of a trommel, supplied by the New York Engineering Company; Hum-mer screens made by W. S. Tyler & Company; Hartz jigs; Wilfley concentrating tables; Worthington pumps; and ball mills supplied by the Allis-Chalmers company. Early in 1930 additional equipment in the form of giants and necessary pipes was furnished by the New York Engineering Company, the water for which is supplied by Worthington high-pressure pumps, used to sluice the overburden; and, at the same time, additional Sauerman Crescent scrapers were added. As a final operation, the diamond-bearing concentrate is treated in ball mills, which, charged with chrome balls, crush all material except the carbons—a reversed, so to say, system of ore dressing.

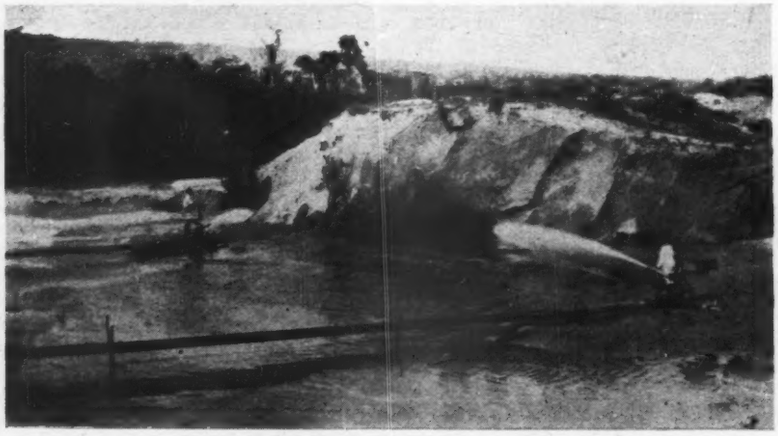
A steam boiler plant and a Westinghouse turbo-generator furnish 600 kw. Wood is the principal fuel used.

Both the native workers and the technical staff of engineers and assistants are well provided for by the Bahia company. Permanent living quarters have been erected for the staff, with a private room for each man, shower bath, electric lights, and electric ice-box refrigeration. Substantial living quarters have been built for the native workmen. Modern dwellings of wood have displaced those of the native type made of adobe. The well-stocked ranch provides food of good quality. Schools and a hospital have also been supplied.

Hauling timber to the sawmill at Moreno. A method primitive and effective

In July, 1930, reports from the property indicated that the treatment method devised by the engineers in charge has solved the problem of mass production. To date the Bahia Corporation has expended over $700,000 in equipment, buildings, and in sanitary and construction activities. All of the stones produced by the company are broken to specified sizes and marketed from New York. The concession is operated on a royalty basis.

As is clearly indicated by the map on page 293, transportation to and from Bahia has become a much more simple matter since the perfection of the airplane. Whereas formerly it was necessary for the engineer to take a ship to Rio de Janeiro, a matter of three weeks or so, there to await the coming of a steamer to take him to Bahia, it is now possible to leave New York on Tuesday of one week by the Seaboard Air Line, to Miami, Florida, from which point a flying boat of the Nyrba fleet travels down the coast of Central



Monitors, just installed, make flank attacks on the overburden

Bedrock, after removal of overburden. August, 1930

and South America as far as Buenos Aires, but stopping at Bahia on the evening of the Tuesday following the day of departure from New York—just a few hours over one week. A total of 5,685 passengers were carried over the New York, Rio and Buenos Aires Air Lines during the six months' period ending July 1, according to an official announcement. During that time the line's planes flew approximately 466,022 miles over South American and West Indian countries without injury to passengers. All flying is by day. On Aug. 22 official announcement was made of the merger of the system with Pan-American Airways. Under present schedules Pan-American Airways System operates 80,868 miles weekly over 18,217 miles of airways. The Nyrba have been flying 27,532 miles weekly over 9,500 miles of airways. Purchase of the Nyrba assets and equipment will swell the Pan-American fleet of modern passenger transports to 134. Although the Bahia Corporation's operations are only now approaching stabilization of production, the use of the flying boat, and the much greater output which seems to be assured by the adoption of the method described, should make possible a steadier and more trustworthy supply of carbonados in the New York market than has heretofore been possible. The company's July, 1930, production of black diamonds exceeded all previous monthly outputs by 300 per cent, regardless of the fact that the mill received sufficient gravel to operate only 71 per cent of the time, and August output ran ahead of that for July. The Bahia Corporation plans to open branches in Canada, Europe, and Africa.

Railway and airway, New York to Bahia

Information under date of Aug. 21 is to the effect that on the Paraguassu River this season the native workings have been hampered by floods, the worst in fifteen years. As the largest two operators have reduced their activities in the district, production of carbonados will this year be materially curtailed. The output of quarter, half, and three-quarter sizes, used largely in past years, will consequently be materially reduced. As a large amount of carbons is being purchased for use in the African copper fields, and by the Russian government, such production from the Bahia district as may be made available should find a ready market.

The United States imposes no duty on carbonados, and white diamonds in the rough are also admitted free.

Acknowledgment is gratefully made to Arthur S. Bandler, A. D. Hughes, and A. P. Rogers for their assistance in making available the data for this article and to Mr. Bandler and Sauerman Bros., Inc., of Chicago, Ill., for the use of the original photographs from which the halftone illustrations were made.

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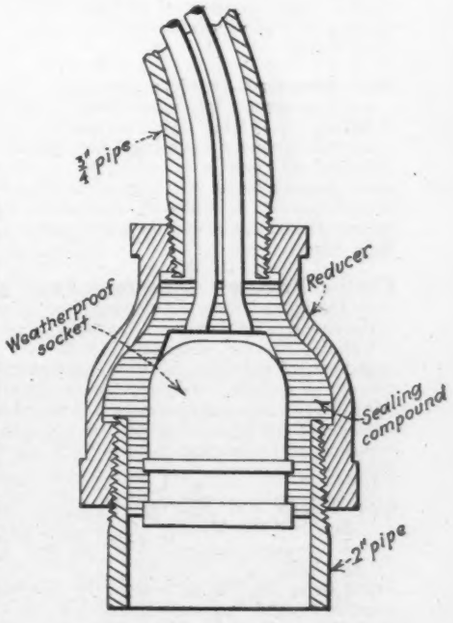
Special Socket Withstands Effects of Blasting

FOR efficient mine operation, electric lights must frequently be used at locations where there is more or less blasting, writes Don Daboll, of Ray, Ariz. Examples of such places are tipple sites where boulders are blasted on pocket screens, and loading stations where débris is occasionally blasted from chute or hopper doors. Sometimes the lights in such places can be protected by installing them behind steel column I-beams, or other structural members; but usually, because of objectionable shadows involved, other methods of protection must be employed. Where comparatively little light is needed, an extension cord or two may be so arranged that cord and light can be moved to a safe place before blasting. When more lights are needed, drop cords with plugs may frequently be installed to advantage. These two methods, however, though easily adopted, are not altogether satisfactory, for the reason that bare spots and short circuits develop in the cords, and because the plugs and receptacles become damaged and fouled.

A less troublesome way of dealing with the problem is to use blast-proof sockets, conduit, and heavy junction boxes, instead of the regular knockout boxes. The blast-proof sockets, which are made of pipe fittings as shown in the accompanying drawing, are screwed into the covers of the boxes. With this arrangement, only the lamps need be removed before blasting. When properly made, sockets of this kind will withstand severe blasts.



Blast-proof electric-light socket

Digest of Current Technical Literature

Selected from abstracts of articles in the leading technical periodicals, prepared by Engineering Index Service, American Society of Mechanical Engineers, 29 West 39th St., New York, N. Y.

Copper Mines and Mining: Norway—Mines of the Orkla Grube-Aktiebolag. *Teknisk Ukeblad,* Vol. 77, No. 23, June 5, 1930.

DESCRIPTION of Loekken pyrites mine, in Norway; production in 1929 was 400,000 tons.—E.I.S., New York.

•

Ore Treatment—Best Degree of Separation in Ore-Treatment Processes. H. Madel. *Metall und Erz,* Vol. 27, No. 11, June 1, 1930.

SIGNIFICANCE and application of Hancock's formula for ore recovery are discussed.—E.I.S., New York.

•

Mine Ventilation—Installation of Room for Underground Fan at Limbourg-Meuse Coal Mine. J. Martelee. *Annales des Mines de Belgique,* Vol. 30, No. 3, 1929.

DESCRIPTION of fan and room in which it is housed.—E.I.S., New York.

•

Grinding Mills: Manufacture—Welding Revolutionizes Manufacturing. *Iron Age,* Vol. 125, No. 25, June 19, 1930.

DESCRIPTION of design and manufacture of grinding mill made by Bauer Brothers Company, of Springfield, Ohio; sketch shows sectional and elevation of hammer mill.—E.I.S., New York.

•

Furnaces, Industrial: Temperature Measurement—The Measurement of Temperature in Furnace Testing. W. C. Buell, Jr. *Fuels and Furnaces,* Vol. 8, No. 6, June, 1930.

DISCUSSION of method of measuring and proper recording of temperature.—E.I.S., New York.

•

Clay Mines and Mining—Economic Handling in Production of Ceramic Raw Materials. F. Reidig. *Keramos,* Vol. 9, No. 9, May 7, 1930.

DETAILS of chain-bucket excavators, draglines, crane shovels for mining of clay and similar raw materials; locomotives and tractors for transport of material.—E.I.S., New York.

•

Salt Recovery—Modern Arrangements for Extracting Salt from Ocean in East Africa. F. Riedig. *Internationale Bergwirtschaft und Bergtechnik,* Vol. 23, No. 9, May 15, 1930.

BRIEF description of salt-extracting plant in Italian colony Somaliland, claimed to be largest ocean salt works in world.—E.I.S., New York.

•

Electric Furnaces: Induction—Progress in Design of Low-Frequency Induction Furnaces. F. Walter. *Siemens Zeit.,* Vol. 10, No. 4-5, April-May, 1930.

PRINCIPLE of induction heating; mechanical motion in metallic molten contents, directions for design, performance of Siemens furnaces, field of application, energy consumption, and operating costs.—E.I.S., New York.

•

Clay Mines and Mining—Recovery of Pillars in Clay Mining. C. Augsburger. *Am. Ceramic Soc. Jl.,* Vol. 13, No. 6, June, 1930.

AFTER brief review of history of former operations and general layout of mine, methods used in National Mine No. 21, at East Canton, Ohio, are described in detail; plan of mine, panel layout, and removal of individual pillars; more than 80 per cent of clay is recovered; conditions and results in number of other mines are given, with illustrations of methods; relation of high percentage of extraction to costs and safety.—E.I.S., New York.

•

Wire Screen Cloth—Report of Committee D-14 on Screen-Wire Cloth. *Am. Soc. Testing Matls.—Advance Paper,* No. 24, 1930.

EXPOSURE tests on non-ferrous screen-wire cloth undertaken by committee have been in position over four years and failures have now been reported; atmospheric exposure and laboratory tests on non-ferrous screen-wire cloth.—E.I.S., New York.

•

Mines and Mining: Russia and Turkey—Development of Mining Under Régime of Communism in Soviet Russia and Under Régime of State Capitalism in Turkey. B. Granigg. *Montanistische Rundschau,* Vol. 22, No. 11, June 1, 1930.

SYSTEMATIC exploitation of raw materials in Soviet Russia; erection of industrial plants; management and distribution; natural resources; geographical and transportation difficulties; awakening of Asia; financing of Turkish industry; the new and the old Turkey; political administration.—E.I.S., New York.

•

Mine Lighting—Efficiency and Rapidity of Mine Working in Relation to Lighting Intensity. C. Koerfer. *Glueckauf,* Vol. 66, No. 15, April 12, 1930.

RESULTS of tests carried out by Society for Inspection of Ruhr Mines, to study influence of lighting on safety and health of miners as well as on efficiency of mining operations.—E.I.S., New York.

•

Limestone—Limestone in Industry. M. F. Goudge. *Can. Min. and Met. Bul.,* No. 217, May, 1930.

PAPER is intended to call attention to manifold uses of limestone in industry; to indicate types of limestone desired by some of large consuming industries; and to give some information on resources of limestone in Canada, so that an idea may be obtained of present and future possibilities for limestone production.—E.I.S., New York.

•

Mines and Mining: Equipment Salvaging—Systematic Control of Materials in Underground Mines. A. Kuenze. *Glueckauf,* Vol. 66, No. 15, April 12, 1930.

ECONOMY of salvaging materials and equipment is set forth; stationary iron and steel equipment; scrap material; mine timbering; organization of salvaging scheme; functions of stores department.—E.I.S., New York.

•

Cement Plants: Grinding Mills—Development of the Separating Partition in the Compound Mill. C. Nadke. *Tonindustrie-Zeitung,* Vol. 54, No. 23, March 20, 1930.

VARIOUS types of partitions which permit properly ground material to pass into next compartment in cement manufacturing process are described.—E.I.S., New York.

Non-Ferrous Metals: Light—Properties of Light Metals as Applied to Construction. F. Gentzcke. *Maschinenbau,* Vol. 9, No. 9, May 1, 1930. See also brief translated abstract in *Automotive Abstracts,* Vol. 8, No. 6, June 20, 1930.

AUTHOR deals with wearing qualities of various alloys; statistical tables showing various physical characteristics, comparing them to those of common steels and irons; effect on metal of method of preparation, strength, ability to stand up under various conditions of use.—E.I.S., New York.

•

Amber—Amber in Industry. *V. D. I. Zeit.,* Vol. 74, No. 25, June 21, 1930.

DATA on amber production in Germany; uses of amber and amber products in manufacture of dyes, electric insulation, alkali- and acid-proof chemical wares.—E.I.S., New York.

•

Miners: Training—Vocational Training at the Hamborn Mining Group of the Vereinigte Stahlwerke A.G. F. Senft. *Glueckauf,* Vol. 66, Nos. 21 and 22, May 24 and 31, 1930.

TRAINING of miners for surface and underground work described.—E.I.S., New York.

•

Iron Mines and Mining: France—Mining and Ore Transportation in Oölitic Iron Mines. O. Berggren. *Teknisk Tidskrift,* Vol. 60, No. 19, May 10, 1930.

MINING and ore transportation in Sancy-Trieux mine and Giranment mine are described.—E.I.S., New York.

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Ore Minerals: Microscopic Analysis—Quantitative Microscopic Analysis. E. Thomson. *Jl. of Geology,* Vol. 28, No. 3, April-May, 1930.

OUTLINE of quantitative methods of Delesse, Rosiwal, Johannsen, Shand, and Wentworth, as carried out on mineral surfaces or thin sections; new variations of Rosiwal method, based on fundamental principal that accuracy of quantitative determination is increased by enlarging scale of measurement or estimation; standards are given for five of common structures in ores. Bibliography.—E.I.S., New York.

•

Copper Ore Treatment: Flotation—Flotation of Copper Ores Containing Oxygen. B. I. Rosov and S. D. Sukhovolskaya. *Tzvetniye Metalli,* No. 2, Feb., 1930.

REPORT on experimental work, done at laboratory of Non-Ferrous Metal Research Institute of Russia, on flotation of malachite; hydrogen-ion concentration; treatment with sodium sulphide; degree of crushing of ore. (In Russian.)—E.I.S., New York.

•

Feed-Water Treatment—Treatment of Feed-Water. *Nat. Elec. Light Assn. Report,* No. 051.

STUDY made to determine proper ratios for prevention of boiler-metal embrittlement; effect of acid, neutral, or alkaline waters and metal stresses on cracking; method of removing ovygen from feed water for 1,300-lb.-per-square-inch boilers; experience in use of continuous blow-down with heat exchangers; methods of boiler feed-water treatment that have given good results; results of carry-over tests and methods used.—E.I.S., New York.

Lead-Zinc Ore Treatment: Flotation—Selective Flotation on a Lead-Zinc Graphite Ore. E. G. Wilkins. *Min. Mag.*, Vol. 42, No. 6 June, 1930.

DESCRIPTION of series of tests carried out at Eagle lead mines, Trefriw, to determine best method for elimination of graphite; flow sheet is given.—E.I.S., New York.

●

Ore Treatment — Metallurgy in 1929. V. Tafel. *Metall und Erz*, Vol. 27, No. 12, second June issue, 1930.

NOTES on progress in ore treatment of platinum, gold, silver, copper, lead, tin, antimony, zinc, cadmium, mercury, nickel, aluminum, and magnesium.—E.I.S., New York.

●

Mine Ventilation: Compressed Air—Ventilation With Compressed Air. W. Schulz. *Glueckauf*, Vol. 66, No. 20, May 17, 1930.

RESULTS of investigation show that use of pneumatic machines in underground mines does not greatly lower temperature, but increases air volume and cooling capacity with regard to convection, which signifies improvement over electric motor.—E.I.S., New York.

●

Asbestos Plants: Dust Hazards—The Occurrence of Pulmonary Fibrosis and Other Pulmonary Affections in Asbestos Workers. E. R. A. Merewether. *Jl. of Indus. Hygiene*, Vol. 12, No. 5, May, 1930.

CONDITIONS necessary to establish relationship between inhalation of asbestos dust and development of fibrosis; composition of asbestos; conditions in industry; analysis of cases.—E.I.S., New York.

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Mines and Mining: Diesel Engines — Junkers Engine for Power at Mines. E. Kittl. *Revista Minera Sociedad Argentina de Mineria y Geologia*, Vol. 2, No. 3, March, 1930.

FACTORS influencing choice of motive power at mines; where water and wood fuel are scarce, Diesel engines furnish simplest and cheapest power; brief discussion of advantages of new Junkers type of Diesel engine; data on consumption of oil fuel and lubricants.—E.I.S., New York.

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Lead-Zinc Ore Treatment: Caucasus—Treatment of Lead-Zinc Ores of Ssadon Mines in Misur Preparation Plant Near Alagir, in Caucasus. H. J. Salau. *Metall und Erz*, Vol. 27, No. 11, June 1, 1930.

NOTES on treatment of ores bearing galena, zinc blende, and iron pyrite; first purely wet washing was employed; later this was combined with magnetic separation, and finally flotation process replaced sludge washing; in newly erected plant employing total flotation, process consists of coarse and fine crushing, flotation, and concentrate dewatering.—E.I.S., New York.

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Copper Smelting—Melting of Sulphide Copper Ores and Concentrates in Pulverized Form. V. A. Vanyukov. *Tzvetniye Metalli*, No. 3, March, 1930.

REPORT on experimental study made at nonferrous metals laboratory of Moscow Mining Academy; author suggests that process studied may take place of enrichment by flotation and may yield copper of high purity, requiring no refining. (In Russian.)—E.I.S., New York.

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Ore Treatment: Concentration — The Effect of Dissolved Substances on Gravity Concentration. F. J. Tromp and E. Beyers. *Jl. Chem., Met. and Min. Soc. of S. Africa*, Vol. 30, No. 8. Feb., 1930.

PAPER is attempt to determine what influence addition of sodium carbonate or caustic soda has on concentration of heavy mineral upon rough surface over which pulp is allowed to flow; substance studied was slime obtained from dump of Zaaiplaats Tin Mining Company.—E.I.S., New York.

●

Instruments: Lubrication — Particulars of Lubrication Technique in Precision Instruments, With Special Regard to Recent Research. P. Cuypers. *Elektrizitaetswirtschaft*, Vol. 29, No. 507, May 1, 1930.

REQUIREMENTS of lubrication of precision equipment are that a drop or a few drops of oil in bearings must give years of service without alteration and without chance of renewal; study is made of consequences resulting from differences between lubricants and lubrication technique of precision equipment and large machinery.—E.I.S., New York.

●

Mine Ventilation—Computation of Fan Efficiency. R. A. H. Flugge-de Smidt. *Jl. Chem., Met. and Min. Soc. of S. Africa*, Vol. 30, No. 9, March, 1930.

FIGURES on quantity of air circulated, and on drop in pressure occurring between intake and outlet when stated quantity is forced through mine, should decide whether contract between fan maker and fan user has been fulfilled; discussion of terminology, test methods, and standardization.—E.I.S., New York.

●

Rock Drills—Developments in Design of Churn Drills for Quarry Blast Holes. *Pit and Quarry*, Vol. 20, No. 6, June 18, 1930.

WIRE supplants manila rope and steel replaces wood for framing machines; details of No. 3½ Keystone well-drilling machine, equipped with 35-hp. cross-mounted, 4-cylinder gas engine, rubber-tired road wheels, and dual rubber-cushion shock absorbers for operation with wire line; and small and lighter machine, all-steel construction, but equipped for use with manila cable.—E.I.S., New York.

●

Mine Timber Preservation—The Preservative Treatment of Mine Timbers. J. F. Harkom. *Can. Min. and Met. Bull.*, No. 217, May, 1930.

THREE classes of mine timbers are enumerated, in respect of preservative treatment; decay of timber; preparation of timber for treatment; treatment of timber; life of treated timber; cost of preservative treatment; two examples are given, as illustrations of cost. Bibliography. — E.I.S., New York.

●

Potash Mines and Mining: Shaft Cementing—Use of Chemical Cementing Process in Rendering Impervious Liquor Dike in Shaft Sinking at the Potash Mines Sachsen-Weimar in Unterbreizbach (Rhoen). A. Lohmann. *Kali*, Vol. 24, No. 6, March 15, 1930.

ORDINARY methods of dike construction did not stop seepage but pumping in silicate and aluminate solutions made effective seal.—E.I.S., New York.

●

Copper Refining: Electrolytic—Utilization of Current in Copper Electrolysis. A. I. Gayev. *Tzvetniye Metalli*, Vol. 4, April, 1930.

RESULTS of detailed analysis of voltage losses and power leaks in Russian electrolytic copper refining plant. (In Russian.) —E.I.S., New York.

●

Lead Mines and Mining: Turkestan—Central Asia Lead. A. I. Shaposhnikov. *Tzvetniye Metalli*, No. 3, March, 1930.

ORGANIZATION of Russian government trust for production of 30,000 tons of lead mined from Turkestan mines; description of principal lead ore deposits; outline of project for construction of lead smelters and development of industrial centers in Ariss, Chimkent. (In Russian.)—E.I.S., New York.

●

Tunnels: Ventilation—New Methods of Effective and Economic Artificial Ventilation of Tunnels. Schmitt. *Organ fuer die Fortschritte des Eisenbahnwesens*, Vol. 85, Nos. 2 and 3, Jan. 15 and Feb. 1, 1930.

CRITICAL review of theory and practice of tunnel ventilating systems; effect of air currents at tunnel portal upon efficiency of ventilation; results of experiments with models, made at Aachen Institute of Technology for determining correct shape of tunnel portals; efficiency tests of Saccardo ventilation system operating in Tauern tunnel, 8.85 km. long. Bibliography. —E.I.S., New York.

●

Mine Shafts: Inclined—Construction of Inclined Shafts for Skip Hoisting. F. Langer. *Beton u. Eisen*, Vol. 29, No. 9, May 5, 1930.

REPORT on construction of concrete lined skip-hoist shaft 88 m. long, measuring from 3.4 to 3.4 by 5.7 m. in cross-section, for coal mine of Falkenauer Kohlenbergbau A.G.; details of concrete reinforcement and skip operation.—E.I.S., New York.

●

Graphite Analysis—Volumetric Carbon Determination in Graphite. E. Berl and H. Burkhardt. *Zeit. fuer Angewandte Chemie*, Vol. 43, No. 16, April 19, 1930.

RAPID method was developed by author for determination of carbon in graphite, similar to method of determining carbon in iron and steel.—E.I.S., New York.

●

Mines and Mining: Compressed Air — Operation and Economy of Some Compressed-Air Systems at Mines in Central Sweden. B. G. Markman. *Jernkontorets Annaler*.. Vol. 114, No. 6, 1930.

REPORT of investigations made at Tekniska Högskolans Compressed-Air Laboratory; results of investigations of designs with and without air storage, showing what savings may be obtained if load on compressor could be evened out so that it worked always at maximum capacity.—E.I.S., New York.

●

Cement Plants: Grinding Mills—Development of Separating Partition Walls of Compartment Mills. C. Naske. *Tonindustrie-Zeitung*, Vol. 54, No. 23. See also translation in *Pit and Quarry*, Vol. 20, No. 8, July 16, 1930.

FOUR types of construction of partition walls or chambers are: with screening on external screens; screening on internal screens; separation on fixed annular slots or gratings; separation on adjustable annular slots; each of which is discussed.—E.I.S., New York.

●

Mines and Mining: Skip Hoisting — Present Status of Skip Hoisting in German Mining Practice. F. Herbst. *V.D.I. Zeit.*, Vol. 74, No. 27, July 5, 1930.

MECHANICAL and mining aspects of skip hoisting; survey of recent progress in German mines; automatic operation of skip hoists.—E.I.S., New York.

●

Iron Mines and Mining: Spain—Mining in Ojos Negros, Sierra Menera, Spain. O. Berggren. *Teknisk Tidskrift*, Vol. 60, No. 28, July 12, 1930.

GEOLOGICAL and geographical description of mining section; description of mining methods; production in 1928 was 516,416 tons iron ore.—E.I.S., New York.

PATENTS

Recovery of Minerals. No. 1,773,212. Aug. 19, 1930. J. S. Woods, Orleans, Calif.

A sluice box for recovery of minerals from ores and sands.

Chlorinating Process. No. 1,773,235. Aug. 19, 1930. T. A. Mitchell, assignor to L. M. Hughes, Denver, Colo.

A two-stage process for chlorinating complex sulphide ores.

Air Drying. No. 1,773,491. Aug. 19, 1930. G. Malyoth, Munich, Germany.

A method for drying air for metallurgical furnaces with calcium carbide.

Ore Crusher. No. 1,773,616. Aug. 19, 1930. J. W. Ericson, Svedala, Sweden.

Design for an ore crusher.

Furnace Lining. No. 1,775,161. Sept. 9, 1930. G. D. Evans, assignor to American Smelting & Refining, New York, N. Y.

A furnace lining consisting of magnesite brick impregnated with a matrix of oxides of copper and absorbed silica.

Mine Ventilating. No. 1,775,488. Sept. 9, 1930. W. H. Evans, Bridgeport, Conn.

Material for ventilating tubing consisting of a dehydrated fabric base impregnated with a fungicide and having a fungicide-retaining coating.

Beryllium. No. 1,775,589. Sept. 9, 1930. H. S. Cooper, assignor to Beryllium Corporation of America, New York, N. Y.

Comminuted beryllium is pressed into a coherent body and melted under a neutral flux, consisting of a halide of an alkali or alkaline earth metal.

Induction Furnace. No. 1,775,351. Sept. 9, 1930. F. Linnhoff, assignor to Ajax Electrothermic Corporation, Trenton, N. J.

Design for a coreless induction furnace.

Electric Furnace. No. 1,775,437. Sept. 9, 1930. O. L. Mills, assignor to Mills Alloys Inc., Los Angeles, Calif.

Design for an electrode holder.

Zinc Metallurgy. No. 1,775,591. Sept. 9, 1930. E. C. Gaskill, Bonne Terre, Mo.

Design for an electric furnace for zinc smelting with an independently supported preheater section located at the top of the furnace.

Mining Prop. No. 1,770,978. July 22, 1930. L. F. Gerdetz, Pittsburgh, Pa.

A mining prop consisting of two slidably connected members.

Drilling Machine. No. 1,771,036. July 22, 1930. G. H. Gilman, Boston, Mass.

Design for a hammer rock-drilling machine.

Rock Crusher. No. 1,771,115. July 22, 1930. C. N. Fulcher, assignor to American Meter Company, New York, N. Y.

Design for a rock crusher.

Flotation. No. 1,771,549. July 29, 1930. R. E. Phelan and S. P. Lowe, assignors to Roscoe H. Channing, Jr., San Francisco, Calif.

Addition of starch and cyanide to an alkaline pulp to separate micaceous and talcky minerals from sulphides.

Ball Mill. No. 1,772,737. Aug. 12, 1930. A. A. Wise and G. Gates, Oakland, Calif.

Design for a ball mill that may be used in inclined positions.

Blast Furnace Tuyere. No. 1,772,865. Aug. 12, 1930. W. A. Haven, Youngstown, Ohio.

Design for a water-cooled tuyère.

Aluminum Metallurgy. No. 1,772,936-37. Aug. 12, 1930. T. R. Haglund, assignor to International Patent Corporation, Maryland.

Process for producing aluminum oxide and electrolysis of aluminum from a bath containing a mixture of crystallized and amorphous aluminum oxide.

Steam Shovel. No. 1,773,066. Aug. 12, 1930. G. Thomas, Old Fort, N. C.

Design for automatic dump for steam shovels.

Rock Drills. No. 1,774,571-72. Sept. 2, 1930. W. A. Smith, assignor to Ingersoll-Rand Company, Jersey City, N. J.

Design for a rock-drill valve.

Ore Concentration. No. 1,774,786. Sept. 2, 1930. J. M. Callow, assignor to Union Carbide Sales Company, West Virginia.

Arrangement for feeding wet ore into a gas-tight inclosure.

Deoxidation. No. 1,774,837. Sept. 2, 1930. G. Masing, assignor to Metal & Thermit Corporation, New York, N. Y.

A process for deoxidation of metals and alloys by addition of a small amount of beryllium.

Iodine. No. 1,774,882. Sept. 2, 1930. C. W. Girvin, assignor to General Salt Company, Long Beach, Calif.

Process for recovering iodine from brine by adsorption on charcoal and treating the charcoal with a reducing acid, washing the resulting hydroiodic acid from the charcoal.

Mercury. No. 1,774,883. Sept. 2, 1930. W. Glaeser, assignor to Glaeser Research Corporation, New York, N. Y.

Extraction of mercury from cinnabar by subjecting it to nascent sulphur in the presence of alkali metals and alkaline earth metals.

Rock Drill. No. 1,774,906. Sept. 2, 1930. J. Smrdel, assignor to the Cleveland Rock Drill Company, Cleveland, Ohio.

Design for a rock drill.

Treatment of Complex Ores. No. 1,762,867. June 10, 1930. F. Johannsen, assignor to Krupp Grusonwerk, Magdeburg.

Treatment of complex sulphides by fractional volatilization.

Nickel Metallurgy. No. 1,770,866. July 15, 1930. S. C. Smith, London, England.

Material containing nickel and copper is first reduced in such a manner that a sponge is formed, and this sponge moistened with acid and exposed to air until a rise in temperature occurs.

Shank and Bit Punch. No. 1,770,873. July 15, 1930. L. C. Bayles, assignor to Ingersoll-Rand Company, Jersey City, N. J.

Design for a shank and bit punch.

Zinc Metallurgy. No. 1,773,779. Aug. 26, 1930. E. C. Gaskill, assignor to St. Joseph Lead Company, New York, N. Y.

Design for an electric furnace in which zinc is reduced from ores at a temperature above the melting point but below the point of volatilization.

Flotation. No. 1,773,787. Aug. 26, 1930. C. G. Quigley, Garfield, Utah.

Flotation process using a frothing agent consisting of a compound of sulphuric acid in which one hydrogen atom is replaced by a metal and the other by an organic radical.

Dust Precipitation. No. 1,773,840. Aug. 26, 1930. A. Nattcher and F. Seipp, assignors to International Precipitation Company, Los Angeles, Calif.

An electric precipitator for suspended material in gases, through which the gas is passed in cyclonic motion.

Dust Precipitation. No. 1,773,876. Aug. 26, 1930. F. Seipp, assignor to International Precipitation Company, Los Angeles, Calif.

An electric precipitator in which the receiving electrode consists of flared channel members.

Electric Precipitation. No. 1,773,951. Aug. 26, 1930. C. B. Clyne, assignor to International Precipitation Company, Los Angeles, Calif.

A collecting electrode for electric precipitators having metallic reinforcing members connected on a supporting cementitious material.

Purifying Zinc Ore. No. 1,773,991. Aug. 26, 1930. O. Gerlach, assignor to Matthiessen & Hegeler Zinc Company, La Salle, Ill.

A process for freeing zinc ores from lead and cadmium by volatilizing these elements.

Flotation. No. 1,774,183. Aug. 26, 1930. F. G. Moses, R. W. Hess, and R. L. Perkins, assignors to The Barrett Company, New York, N. Y.

The mineral to be floated is mixed with a sulphide of the probable formula $R\text{-}S_x\text{-}R^1$ wherein R and R^1 stand for the same or different alkyl or arakyl hydrocarbon radicals and x has a value of 1 or more.

Rock Drill. No. 1,774,266. Aug. 26, 1930. H. C. Gustafson, assignor to Gardner-Denver Company, Denver, Colo.

Design for a variable-stroke tool.

Rock Drill. No. 1,774,290. Aug. 26, 1930. G. C. Pearson, assignor to Gardner-Denver Company, Denver Colo.

Design for a bore-contracting device.

Rock Drill. No. 1,774,302. Aug. 26, 1930. E. F. Terry, Jr., assignor to Gardner-Denver Company, Denver, Colo.

Design for an automatic valve for rock drills.

Mine Car. No. 1,774,344. Aug. 26, 1930. V. Willoughby, assignor to American Car & Foundry Company, New York, N. Y.

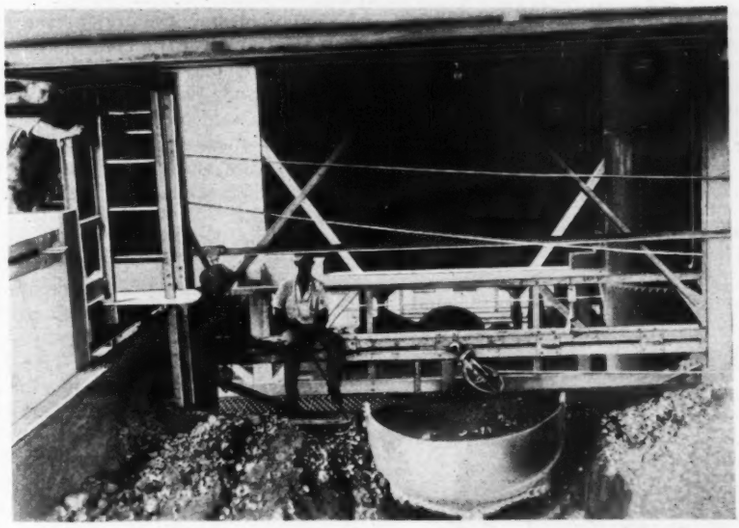
Design for a mine car.

Lead Refining. No. 1,774,359. Aug. 26, 1930. T. H. Donahue, East Chicago, Ind.

Process for refining crude antimonial lead containing copper and arsenic by mixing the molten metal with zinc and removing the dross thus formed.

INDUSTRIAL PROGRESS

A Striking Indoor Application of the Power Scraper



Small scraper dragging "green" bauxite ore to chute that feeds the kilns

AT ITS bauxite mining, crushing, and drying plant at Bauxite, Ark., the Republic Mining & Manufacturing Company, subsidiary of the Aluminum Company of America, recently installed two 120-ft. rotary kiln dryers in place of 60-ft. dryers previously used, and the increased capacity called for the replacement of hand labor with mechanical means for handling the bauxite from the green-ore storage platform to the kiln feeders. This work is now being done by a ¾-cu.yd. Sauerman power drag scraper, an installation of particular interest, partly because indoor applications of power scrapers are not as frequent as their outdoor uses, and partly because the scraper works on an area considerably smaller than is customary.

The space available for storage is a room 36 ft. wide by 48 ft. long and about 15 ft. high from the feeding platform to the lower member of the roof truss. A conveyor belt that carries the ore from the crusher runs along the top of the room, under the gable roof, and drops the ore into storage on the pile below. The task of the scraper is then to feed the bauxite from this pile to any of three chutes along one of the 48-ft. sides, from which the ore is carried to the kilns by pan-type feeders.

The two-drum scraper hoist is mounted on a platform just outside one corner of the storage room, and the operating cables pass from the hoist drums over fairlead blocks and thence to two movable guide blocks that control the scraper's line of operation. At each of the chutes where the scraper discharges are three U-bolts, into which the forward guide block can be hooked as desired to change from one chute to another or between any of three loading positions at each chute. Similarly, a continuous row of U-bolts of 3-ft. spacings around the other side and the two ends of the room provide anchorage for the tail block at any desired position; the path of the scraper bucket, working between the two guide blocks, can thus be shifted at will to reclaim material from any part of the room. Small chain hoists on trolley rails above the rows of U-bolts are provided for rapid shifting of the guide blocks.

The scraper system operates an average of fifteen minutes per hour to deliver to the kilns the required hourly tonnage of 30 tons.

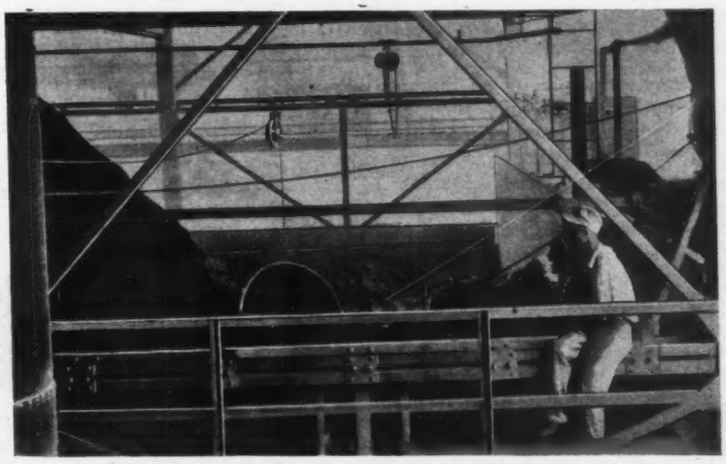
■

New Bearing Metal

W. C. Wilharm, of the Westinghouse Research Laboratories, has invented a new bearing metal in the form of a self-lubricating bearing. With it a bearing having many times the efficiency of the so-called oil-less bearings may be obtained, it is said. Practically all bearings of this kind are mounted without oil or grease in motors which turn only a few revolutions and then are idle for a considerable time.

The new bearing can also be used with lubricant in place of the bearing materials that require oil. If the film of lubricant should for any reason become inadequate, the bearing is able to resist the heating action or friction for a considerable time by means of its own lubricating qualities. This development is thought to show promise of revolutionizing the construction of bearings, once the metal has been placed on a production basis and the cost reduced.

Scraper at back of storage platform ready to bring forward a load of ore

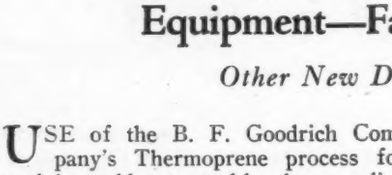


Rubber Covering Now Applied to Dorr Equipment—Fan-Cooled Motors

Other New Devices Introduced

USE of the B. F. Goodrich Company's Thermoprene process for applying rubber to steel has been applied by The Dorr Company to its equipment. A plant for the purpose has been provided and already more than 5,000 sq.ft. of rubber has been successfully applied to thickeners, agitators, rod mills, ball mills, pumps, filters, and similar equipment.

The stock used in the process is abrasion and to the action of acid solutions at temperatures up to the boiling point. The rubber may be applied to rolled-steel parts, such as bars, plates, and shapes, to iron and steel, and to alloy castings.



Dorr rubber-covered equipment

Where acid solutions are handled, the rubber-covered machines are expected to be especially useful, in that the parts may now be made for maximum strength and minimum cross-section, using steel protected by rubber instead of lead-covered steel or wood.

The low coefficient of friction of wetted rubber presents attractive possibilities wherever wetted, granular materials are carried in troughs and launders. For example, where a plain steel trough had to be pitched at a slope of 5 in. per foot to handle plus 100 mesh sands containing 18 per cent moisture, it was possible to reduce the slope to 3½ in. by covering the trough with rubber. In another case a plain trough sloping two inches per foot and handling sands containing 25 per cent moisture was successfully replaced by a rubber-covered trough sloping only 1 in. per foot.

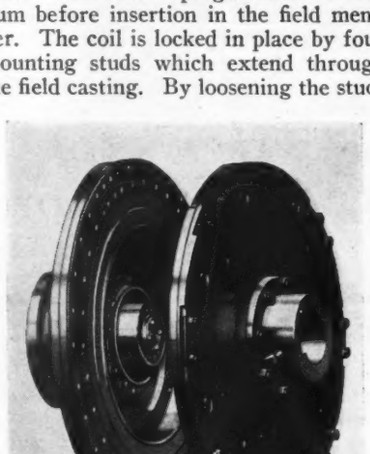
Some New Fan-Cooled Motors

The Mossay principle of cooling is used in a new line of fully inclosed fan-cooled induction motors recently introduced by the Reliance Electric & Engineering Company, 1042 Ivanhoe Road, Cleveland, Ohio. These have been brought out in sizes of 20 hp., at 1,200 r.p.m., and up to 150 hp. This method of cooling is used for the larger sizes because the design of the smaller motors does not provide sufficient cooling area. The extra cooling area is secured by using tubes extending over the outside of the stator. A single internal fan on the rotor circulates the confined warm air through the tubes, over which are blown blasts of cool outside air from one end of the motor to another.

New Magnetic Clutches

An accompanying cut shows a magnetic clutch, which is one of a line just announced by Cutler-Hammer, Inc., Milwaukee, Wis. This clutch is known as the Type L, because the cross-section of the armature is L-shaped, the armature fitting around the magnet coil and thus giving a greater and steadier magnetic pull throughout the life of the lining.

The magnet coil is wound on a sheet metal form and impregnated in a vacuum before insertion in the field member. The coil is locked in place by four mounting studs which extend through the field casting. By loosening the studs it may be removed. An improved centering bearing has been provided, assuring perfect alignment and concentric engagement. The collector rings have also been improved.



New magnetic clutch

Measures Pressure and Flow at Same Time

A new instrument of the U-tube manometer type has been introduced by the Meriam Company, Cleveland, Ohio, for indicating simultaneously the line pressure and the rate of flow of liquids or gases in pipe lines. It differs in construction from the previous combination type developed by the company last year for the same purpose. This instrument is expected to supersede the former.

Another Motor Starter

To facilitate across-the-line starting of squirrel-cage and synchronous motors, and also to control the primary of slip-ring motors, the Electric Controller & Manufacturing Company, Cleveland, Ohio, has introduced a new 2,300-volt, full-voltage magnetic starter, complete with overload relays and a self-contained potential transformer (to secure 220 volts for the control circuit). The starter is built for reversing, nonreversing, and plugging applications. Its design is said to be radically different from the switchboard circuit-breaker type of starter used in the past for full-voltage starting of high-voltage a.c. motors.

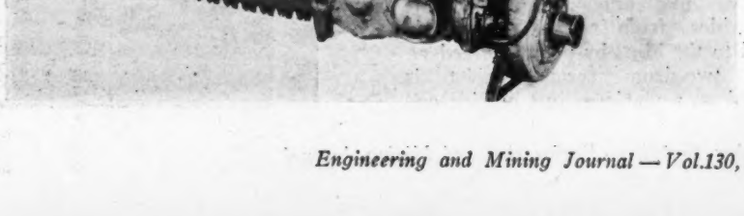
New Pyrometer

A so-called "self-contact" potentiometer pyrometer has been introduced by the Uehling Instrument Company, 134 Vesper St., Paterson, N. J. This has been designed primarily for measuring high temperatures in the iron, steel, and ceramic industries, but is said to be suitable for recording any temperatures where high accuracy is required. Either a thermocouple or an electric-resistance bulb may be used as the temperature element. A novel method of making contact between the needle of the galvanometer and stationary contact pieces is used, which permits placing the galvanometer at almost any distance from the recorder. In turn, this makes possible a very simple and rugged recorder construction.

Gasoline-driven Portable Saw

An accompanying illustration shows a portable saw driven by a 4-hp. air-cooled gasoline motor. This is the new so-called Wolf timber-sawing machine developed by the Reed-Prentice Corporation, Worcester, Mass. The motor is a single-cylinder, two-cycle type, equipped with a Bosch magneto and a two-quart tank. A multiple-disk clutch is provided, which slips when there is any tendency to stall. The saw is made with a swivel movement so that cutting may be done either vertically or horizontally, allowing the engine to remain vertical.

The Wolf portable timber saw



Personal Notes

Kilian E. Bensusan sailed from New York for London on Sept. 18.

W. Fife, mining engineer, is now residing at 3870 Jackson St., San Francisco.

Huntington Adams is expected in New York, from South Africa via London, early in October.

K. A. Cameron has returned to Australia after a tour of mining districts in Canada and the United States.

J. G. Flynn, manager of Shattuck Denn, has returned to Bisbee, Ariz., after a business trip to the East.

O. B. Hofstrand, consulting engineer, of Salt Lake City, Utah, was in New York on business early in September.

Rush M. Hess has returned to New York after a three months' examination trip to Colorado, Oregon and California.

R. D. Leisk, of Jerome, Ariz., is examining properties in the Lake Chibougamau district of northeastern Quebec.

Alfred James plans to sail late in October from London for South Africa, where he expects to reside for the next three years.

Blamey Stevens is now managing director of Lane-Rincon Mines, operating silver properties at Via Toluca, State of Mexico, Mexico.

N. L. Stewart, of the Western department of American Smelting & Refining, is at Copperhill, Tenn., where he expects to remain until early in October.

Frank L. Sizer, consulting mining engineer, of San Francisco, recently returned from a professional trip to the southern part of the State of Sinaloa, Mexico.

W. A. Doman, editor of *The Financial News,* of London, and for more than ten years London correspondent for *Engineering and Mining Journal,* has retired because of ill health.

E. E. Paine, of Boston, and **Chester S. Breining,** of New York, have been elected directors of the American Zinc, Lead & Smelting Company, succeeding **W. A. Ogg** and **Stephen L. Bartlett,** resigned.

C. M. Eye, mining engineer, of San Francisco, presented a paper, descriptive of mining activities in the Philippine Islands, before the San Francisco section of the A.I.M.E., at its meeting on Sept. 11.

I. J. Nygard is in charge of research on the value of commercial fertilizer at the Montana Agricultural Experiment Station, toward the cost of which Anaconda Copper Mining has contributed $5,000.

H. H. Ray, for the last three years general superintendent of Benguet Consolidated, operating a gold property in the Philippine Islands, has returned to the United States, and is temporarily at Los Gatos, Calif.

A. W. Hahn, consulting metallurgist, has returned to his offices in Salt Lake City, Utah, from a five months' trip to Russia, where he was engaged as consultant to the non-ferrous metals and gold trust of the U.S.S.R.

J. N. Houser, general manager of the Tennessee Copper & Chemical Company, at Knoxville, Tenn., is now in New York. He was recently in Cincinnati, attending the general meeting of the American Chemical Society.

W. A. DOMAN

Dr. **Freidrich Prockat,** whose article, "Amber Mining in Germany," in the March 24 issue of *E.&M.J.* will be recalled, is visiting the United States with the American excursion of the Institute of Technology, of Berlin.

H. M. Lawrence, until recently with the General Chemical Company, as metallurgist at the company's plant at Cliffview, Va., was in New York for a short time in the latter part of September.

James F. McCarthy, of Wallace, Idaho, president and general manager of Hecla Mining, is spending a few weeks in the Hawaiian Islands. He is accompanied by his son, **James F. McCarthy, Jr.** They expect to return late in October.

C. W. Nichols will be chairman of the board of Nichols Copper, and will be made a director and member of the executive committee of Phelps Dodge. **L. S. Cates,** president of Phelps Dodge, will act as president of Nichols Copper. These appointments result from the recent merger of the two companies.

F. L. Partlo, J. M. Harrington, and **T. C. Sermon,** of the faculty of the Michigan College of Mining and Technology, are doing graduate work for advanced degrees at the University of Wisconsin. They are carrying on research investigations in the physics of rock formations and the magnetic permeability of different rocks.

Dr. **Thomas B. Brighton** has been appointed acting professor of metallurgy at the University of Utah, taking the place of Dr. **R. H. Bradford,** who is on leave of absence, which he is devoting to the writing of a treatise on metallurgy. Dr. Brighton is a graduate of Utah, class of 1913, and received his advanced degrees from the University of California.

William H. Peirce, vice-president of American Smelting & Refining, and president of the refining subsidiary at Baltimore, Md., known as the Baltimore Copper Smelting & Rolling Company, was given a banquet recently at Baltimore by 40 of his associates, in honor of his 40 years' service with the company. Mr. Peirce was partly responsible for the invention of the Peirce-Smith converter, now widely used in copper smelting.

OBITUARY

Fred F. Smith, assistant director of sales, explosives department, Hercules Powder Company, died on Sept. 6, after a short illness. He was 48 years of age.

Edward Walser, metallurgist, of Denver, Colo., died at his home on Aug. 28, after several years' illness. He was 56 years of age, and is survived by his widow and three children.

Joseph H. Hutchinson, former Lieutenant Governor of Idaho, and connected with the development of several Western mining properties, died in San Francisco on Sept. 5, after a short illness.

Edward G. Kane, assistant general superintendent of mines at Butte for Anaconda Copper, died on Sept. 12. He was 42 years old and had been connected with Anaconda since 1909, when he graduated from the Montana School of Mines.

Murray C. Godbe, president and general manager of Ophir-Mono Mining, died on Sept. 1, at a hospital in Salt Lake City, after a short illness. He was born in Salt Lake City on Sept. 20, 1870. His father, W. S. Godbe, was one of the first mining operators in Utah. At the time of his father's death, Murray took over the management of the estate, subsequently developing several properties in the Ophir district of Utah, and others in the Pioche district of Nevada.

Col. **Robert M. Thompson,** one of the organizers of the International Nickel Company, died at Fort Ticonderoga, N. Y., on Sept. 5, at the age of 81, after a long illness. He was born at Corsica, Pa., and practiced law in Boston until 1879, at which time he began to devote all of his time to the active direction of several metal-mining enterprises, including Orford Copper, which he organized. In 1901, together with S. J. Ritchie, he consolidated a group of properties in the Sudbury district of Ontario into the International company, which has since absorbed most of the other factors in the field of nickel production. Colonel Thompson was responsible for much of the early work done in developing a market for nickel, particularly its use as an alloying metal in the manufacture of armor plate. Colonel Thompson was widely known as a sportsman and a supporter of the Olympic games. He is survived by his daughter, Mrs. S. H. P. Pell.

NEWS OF THE INDUSTRY

New Climax Crushing Plant Virtually Completed

Construction of the new crushing plant of Climax Molybdenum at Climax, Colo., has been practically completed. The 750-ton concrete coarse-ore bin is finished, and the 60x48-in., all-steel Buchanan jaw crusher has been erected and is ready to run. Both the 7-ft. Symons cone crusher and the 5½-ft. Symons cone crusher have also been installed, and all that remains to be done before putting the crushing plant into operation is the installation of a Ross feeder ahead of the jaw crusher and the completion of the conveyors and screens. The plant will be ready for operation by Oct. 1. It will reduce ore passing through 30-in. grizzlies to a ⅜-in. ball mill feed, and is expected to have a capacity of 2,500 tons per shift.

Phillipson tunnel, which is being driven 450 ft. below the old workings, is now advanced to 2,750 ft. and has 1,500 ft. yet to go to meet the immediate objective, which is the bottom of a transfer raise from the upper tunnel. The top of this raise is located near the portal of the upper White level. The Mosquito fault was encountered in the tunnel at 2,230 ft. and the broken zone extended to 2,290 ft. This fault is striking almost north and south and is dipping to the west at 75 deg. West of the fault, between 6 and 8 ft. of gouge was encountered. It appeared to be composed of ground-up shales. After passing through the fault and between 2,300 ft. and 2,600 ft., water was encountered. The flow from this area is approximately 700 g.p.m., as indicated by weir readings. At present, the face of the tunnel is in highly altered silicified granite and, though the tunnel is not far enough advanced to be into the commercial ore zone, the rock is well fractured and mineralized with molybdenum.

■

Mazapil Copper Closes

Reports from Mexico City state that on Sept. 15, the mines, mills, and smelter of Mazapil Copper, British-controlled producer of lead, copper and silver, were closed. The properties of the company are at Concepcion del Oro, Zacatecas, and Saltillo, Coahuila. Production in 1929 of this company was 6,239 tons of copper, 6,130 tons of lead, and 1,182,696 oz. of silver. The company employed several thousand workmen.

■

Mullan Area Under Day Control

The Day organization, of Wallace, Idaho, has taken over control of Copper King Mining & Smelting. This control was exercised at a recent meeting of stockholders by electing a new board of directors and moving the office of the company from Mullan to Wallace. The Copper King property consists of a large group of silver-lead claims near Mullan, which has been the scene of extensive development covering a long period of years. Results have been disappointing. Since becoming interested in the property, engineers and geologists of the Day staff have made a study of Copper King, and, now that the company organization has been formally taken over, a systematic plan of development will be undertaken.

■

Tri-State Mines Reopen Despite Low Zinc Price

Despite continued unsatisfactory prices for zinc concentrates, production in the Tri-State district continues to mount as mines that have been idle for months resume production. The two mines of Admiralty Zinc, closed early in the spring, have been reopened. Ramage Mining Company has reopened its mine, after a shutdown lasting several months. Otis Mining has started a mill, built northwest of Baxter Springs at the end of last year. The mine was not opened when the price slump came. The Otis is owned by Otis White, L. H. Cartwright, M. E. Richards, and Ed McKay, all of Joplin.

White-McKay Mining, which several months ago purchased a lease on the old Martha B mine, south of Baxter Springs, has completed a new shaft on the south 40 acres of the 80-acre lease, which shows a good run of ore from the 100 to the 170 level. More than $30,000 is being spent in remodeling and enlarging the Martha B mill. Capacity will be increased from 15 tons to 25 tons an hour. Flotation equipment will be installed also.

George Beck, of Miami, is moving the old Tri-State mill, which he recently bought, from west of Commerce, Okla., to the Hocker lease, in Baxter Springs. Two shafts have been completed on this lease and considerable development work done while consent was being obtained from the Indian department of the Department of Interior to move the Tri-State mill. The new plant will have a capacity of 40 tons an hour.

■

Fraser Brace Gets Contract for Copper Cliff Separating Plant

Fraser Brace Engineering has secured an additional $2,000,000 contract from International Nickel on its Copper Cliff plant, in Ontario. This expenditure will be used for the purpose of a new unit to carry out part of the separation of nickel and copper from the matte which is now being handled at the company's Port Colborne refinery. With the completion of this unit, all steps in ore treatment except the actual refining of the nickel will be done at Copper Cliff. Further expenditures are also to be made on the surface plant at the Frood mine. The low prices for metals and the industrial reaction have not resulted in any curtailment of operations or expenditures by International Nickel.

Hudson Bay M. & S. Starts Zinc Plant at Flin Flon

Operation of the electrolytic zinc plant of Hudson Bay Mining & Smelting at Flin Flon, northern Manitoba, was started in the middle of September, according to R. H. Channing, Jr., managing director of the company at Winnipeg. The company's concentrator has been running for the last month or so, and the copper smelter will start early in October, thus bringing into production the entire enterprise, on which more than $20,000,000 has been spent by the present company.

Output of the zinc plant, operating at capacity, will be about 25,000 tons annually on the basis of the company's present plans. Unlike the copper smelter, which will handle Sherritt Gordon concentrate, the Flin Flon electrolytic zinc plant will probably be restricted almost entirely to company concentrate. It will use about 13,000 kw. Equipment includes six seven-hearth Wedge roasters and 450 electrolytic cells in the cell house.

According to the company's annual report, Flin Flon will be mining and milling 3,000 tons of copper-zinc ore daily by the end of the year. At present, about 1,000 tons is being handled daily. Of the total tonnage, 2,000 tons will be mined from the open pit and 1,000 tons will be mined from underground daily, although hoisting capacity is 3,000 tons per eight-hour shift.

The copper smelter, now nearing completion, includes three ten-hearth Herreshoff roasting furnaces, one 100x22-ft. reverberatory furnace, and two 13x30-ft. Peirce-Smith converters. It has a capacity of about 750 tons of charge daily, sufficient to handle about 225 tons of Sherritt-Gordon concentrate and some additional custom ore and concentrate as well as company copper concentrate.

■

C. & H. Curtails Further

Official announcement has been made that all departments of Calumet & Hecla Consolidated Copper, largest producer in the Michigan copper district, were placed on a five-day week basis, beginning Sept. 20. The curtailment is caused by the continued depression in the copper price. In recent years the company has produced about 65,000 tons of copper annually.

■

San Francisco Not to Close

Reports from London to the effect that San Francisco Mines of Mexico, large lead-zinc producer operating in Chihuahua, Mexico, was preparing to suspend all operations have been denied by E. A. Strout, general manager of the company. The concentrator is now handling about 1,000 tons of ore daily and producing 4,000 tons of lead concentrate and 3,500 tons of zinc concentrate a month. Capacity is being increased to 1,350 tons daily.

C. & A. Orders New Hoist for Junction Shaft

A new electric hoist, even larger than that recently installed at its Campbell shaft, has been ordered from Allis-Chalmers by Calumet & Arizona Mining to replace the Nordberg steam unit now in operation at its Junction shaft, in the Bisbee copper district, of Arizona. Until the installation of the new Campbell hoist, all C. & A. ore was raised through the Junction shaft, but the development of the high-grade Campbell orebody made equipment of the Campbell shaft for hoisting necessary.

Shipment of the hoist and its accessory equipment to Bisbee will be made shortly after Jan. 1. It will be driven by a 1,500-hp. Allis-Chalmers motor, as compared with the 1,350-hp. motor of the Campbell hoist. Other specifications for the new Junction unit compare with the Campbell equipment as follows, Campbell figures being given in parentheses: Ultimate hoisting depth, 5,000 ft. (3,600 ft.); drum diameter, 12 ft. 6 in. (10 ft.); rope speed, 2,000 ft. per minute (2,000 ft. per minute); and load capacity, 16 tons (5½ tons). Inasmuch as the Campbell shaft is now down to only 2,340 ft. and the Junction shaft to 2,200 ft., the ultimate hoisting depths for which both hoists are designed is an indication of the company's confidence in the continuation of its orebodies at depth. Because of the high cost of keeping the workings unwatered, only four to five years' ore reserves are maintained definitely in sight at the property.

■

Freeport Sulphur to Work Humble Field Deposits

Besides the sulphur rights which Freeport Sulphur recently secured to more than 2,000 acres of land, embracing the Stratton Ridge dome in Brazoria County, it has acquired similar rights to about 1,000 acres in the Humble oil field of Harris County, Tex. Twelve test wells have been drilled and four more are now in process of drilling. All rigs are electrically operated. Freeport Sulphur paid $200 an acre bonus for the leases and it agrees to pay 50c. a long ton on all sulphur that may be produced. Active sulphur-mining operations in the Humble field will be started the early part of 1931, according to present plans. Officials of the company will make no estimate of possible production or the potential quantity of sulphur in the new field.

■

Tri-State Producers to Meet in Picher on Oct. 6

Eighth annual meeting of the Tri-State Zinc and Lead Ore Producers' Association will be held at the offices of the organization, Picher, Okla., on Oct. 6, according to M. D. Harbaugh, secretary. Election of officers and the work of the association for the past year will be reviewed. The association's new officers will be faced with some revision in the budget for the coming year. The slump in business, which has hit the zinc industry a hard blow, has reduced the income of the association considerably. At present the association collects 15c. a ton for each ton of concentrate produced by its members. Production by contributing members this year will be less than 400,000 tons, as against 500,000 tons last year.

A deficit of more than $10,000 for the past year is expected to be shown at the annual meeting. The association has a reserve fund of more than $20,000, built up during flush times when the association was collecting 25c. a ton from members. Frank Childress, of Joplin, is president of the association.

■

Goldfield Deep Plans Sinking Shaft to 2,750 Level

Sinking of the main shaft of Goldfield Deep Mines, at Goldfield, Nev., to the 2,750 level will be undertaken, according to A. I. D'Arcy, president of the company. At present the shaft is bottomed at 2,150 ft. Drilling from the 2,150 level indicated a heavy water flow at depth.

Goldfield Deep has been engaged in exploratory work at 2,150 ft. for the last three years. More than 6,000 ft. of drifts, raises, and crosscuts has been driven without encountering ore, although a considerable quantity of geological data has been obtained. The formation on the 2,150 level proved to be entirely in shale and alaskite, whereas drilling has indicated that below 2,365 ft. it changes to latite and dacite, in which the large oreshoots were opened on upper levels.

Water has been the main problem in the exploratory operations, as the entire district had to be drained through the Goldfield Deep shaft, the only one in which work is now being done. Pumping has been maintained continuously for the last three years, and the water level has been lowered materially.

■

United Mercury Applies for Salmon River Power

Application for a license to develop power on the east fork of the south fork of the Salmon River, in Valley County, Idaho, has been made to the Federal Power Commission by United Mercury Mines, of Boise, Idaho. The company proposes to build a concrete diversion dam, a 2-mile flume, and a power house. A transmission line, 3 miles long, will be built to carry the power generated to the company's mining and milling operations.

According to the annual report of Stewart Campbell, Inspector of Mines in Idaho, the properties of United Mercury Mines are being operated under lease by Yellow Pine, an enterprise backed by the F. W. Bradley interests. Quicksilver, gold, and silver are the chief metal constituents of the deposits.

■

Storm Closes Athletic Smelter

Two 140-ft. stacks at the kiln plant of the South Fort Smith plant of Athletic Mining & Smelting, in Arkansas, were blown over on the kiln house of the plant during the storms that visited the Middle West on Sunday, Sept. 14, inflicting damages that will force the smelter to close for two or three weeks, according to C. T. Orr, of Joplin, president of the company.

New Orebody Indicated by Drill Hole at Pecos

A diamond-drill hole, put down from the No. 7 level of the Pecos mine of American Metal, at Glorieta, N. M., has cut what appears to be an entirely new orebody at a depth of 930 ft. This ore occurs in what is apparently a third shear zone, running parallel to the Evangeline and Katydid shear zones in which the present known orebodies occur. The ore is about 200 ft. east of the Evangeline and several hundred feet north of the main shaft. Previous drilling east of the Evangeline shear zone had been confined to a section south of the main shaft and had cut mineralization but no ore.

True width of the ore cut is not known, but it is estimated to be from 10 to 15 ft. The grade is somewhat lighter in zinc and silver than the average run-of-mine ore, and it shows nearly 8 per cent lead, compared with an average of about 4 per cent lead in other parts of the mine. Practically no copper is contained. Further development of this orebody will be undertaken through a crosscut from the No. 10 level, on which lateral work was recently started.

■

Universal Exploration Mill Giving Consistent Results

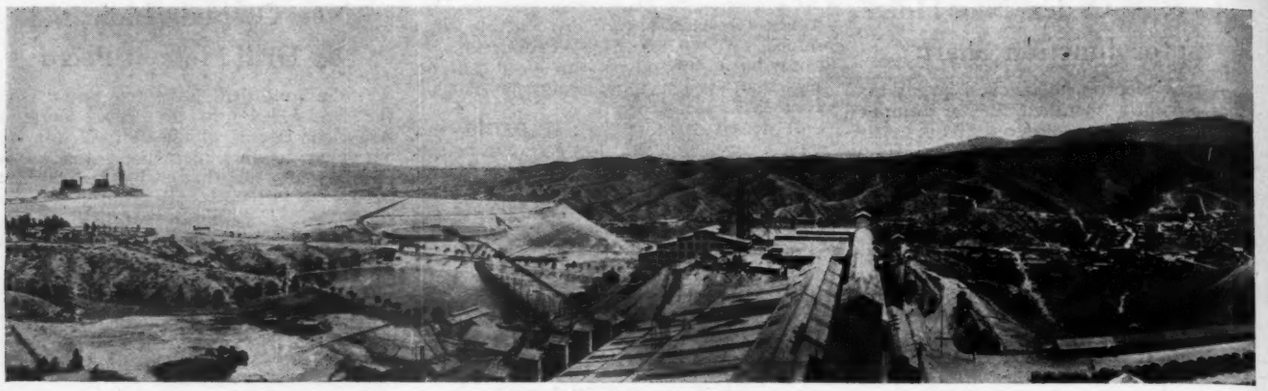
Operation of the new 800-ton zinc concentrator at Jefferson City, Tenn., has given results that E. E. Ellis, president of Universal Exploration, believes to be unique both because of the uniformity and the high grade of the zinc content of the flotation concentrate. In the last 33 cars shipped to the smelter, up to Sept. 12, the grade per car was never less than 64 per cent or more than 65.5 per cent zinc. The average was 64.8 per cent. Inasmuch as blende carries 67 per cent metallic zinc, the grade indicates the concentrate contained less than 4 per cent gangue. Floyd Weed is general superintendent and metallurgist of the plant.

Universal Exploration, a subsidiary of U. S. Steel, holds about 1,200 acres of ground at Jefferson City, on which are deposits similar to the deposit operated at the near-by Mascot mine by American Zinc, Lead & Smelting. No lead is contained in the ore. The mill was built at a cost of $1,000,000 to permit expansion to 2,400 tons daily when desired. It started operations in March and is now handling about 600 tons of ore daily.

■

Mines at Cerro Resume Work

Rioting at the Cerro de Pasco mines of Cerro de Pasco Copper, in central Peru, affected production only for a few days early in September and by the middle of the month the mines were again operating at normal rate, according to reports received at the company's New York office. Detailed information concerning the nature of the riots or the persons responsible is not yet available, but it is clear that only the mines at Cerro were affected and that the company's other mining units, as well as the Oroya metallurgical works, were not troubled. The company is the largest producer of non-ferrous metals in Peru.



This view, taken from the headframe of a shaft at Miami Copper, shows the roof of the concentrator, the crushing plant at No. 5 shaft, the tailing pond, and, in the distance, the International smelter

Fresnillo Asks Permission to Close Oxide Unit

Application for permission to suspend work on its low-grade silver oxide deposit at Fresnillo, Zacatecas, Mexico, has been made by the Fresnillo Company, in which the Mexican Corporation has a half interest. The drop in the price of silver to about 35c. an ounce has wiped out the slender margin of profit on which oxide operations were maintained, despite the fact that mining and milling costs have been cut to $1.50 per metric ton. The grade of the oxide ore is only 6 oz. of silver and 0.1 dwt. of gold to the ton, with recovery less than 5 oz. Suspension of operations at the oxide unit will not affect the sulphide lead-zinc-silver unit, which is still making a profit. In the second quarter of 1930, 197,154 metric tons of oxide ore and 62,951 tons of sulphide ore were milled.

Development results in the sulphide unit have been favorable recently, thus improving the stoping situation, and development work may be curtailed in the near future. About 12,000 ft. of development and 2,000 ft. of diamond drilling have been done each quarter. Drifting west on the 425-m. level of the Cueva Santa vein has added 393 ft. to the length of the main orebody. This new work showed an average grade of 13 per cent lead, 15 per cent zinc, 0.2 per cent copper, and 9.6 oz. of silver to the ton over a width of 4.6 ft. A branch that joins the main vein at both extremities to form a lens of waste has been proved on this level. This branch is 236 ft. long, 3.6 ft. wide, and has a higher zinc, though slightly lower lead and silver, content than the main orebody. Results on the 385-m. sub-level have been equally encouraging. Ore developed in this section indicates a metal production not equaled by an other unbroken area in the mine of equal size, the management states.

The crosscut from the east winze on the Cueva Santa vein has cut the orebody at the 470-m. level and shows it to be 5.6 ft. wide with a grade of 7 per cent lead, 11 per cent zinc, 0.3 per cent copper, and 6.6 oz. of silver to the ton. A footwall vein, 1.6 ft. wide, has also been cut. The east winze is now well below 500 m. and is being continued to 550 m. The Saraos shaft has reached a depth of 594 m. and work of crosscutting at that depth has started.

In the Plomosa vein, discovered a little more than a year ago, 170,000 tons of ore has already been proved. Grade is 7 per cent lead, 6 per cent zinc, 1 per cent copper, and 8.9 oz. of silver to the ton. Lateral development of this vein has been stopped without defining the western limit so as to complete preparations for stoping. Although narrow, the management states that the vein promises to become a producer of major importance. In addition, diamond drilling has cut a new vein northeast of the Plomosa vein on the 270-m. level. It has a high silver content over a width of about 2.6 ft. A hole is being drilled at 165 m. to cut the upward extension of this vein.

■

Steel Men Oppose Embargo on Russian Manganese Imports

Manganese imports from Soviet Russia were defended by the American steel industry on Sept. 9 at a hearing held by officials of the U. S. Treasury to determine whether or not action should be taken under the anti-dumping clause of the tariff. Amtorg representatives were not present, sending word that they will await developments in silence. A decision will probably not be made by the government for several months.

At the hearing, Thomas J. Doherty appeared for the American Iron and Steel Institute. He pointed out that the anti-dumping clause can be invoked either against sale in the United States below the domestic selling price of the foreign nation involved or below the price to other foreign consumers. On the first count, he declared that internal Russian demand is small and is satisfied by low-grade ore from the Nikopol district, in the Ukraine, whereas export ore is high-grade from the Tchiaturi district, in the Soviet Republic of Georgia. A Russian affidavit was offered to this effect. J. Carson Adkerson, president of the American Manganese Producers' Association, objected on the ground that Russians are godless people and cannot swear oaths. Nevertheless, the evidence was admitted. Anent sales to other nations, trade papers were cited to show that prices to the United States tend to be higher. Manganese prices have not declined in the world market as rapidly as several other non-ferrous metals, Mr. Doherty asserted. The present duty was held to be adequate because it already stands at 22.4c. per long-ton unit, which is valued at 20 to 22c. at ports of foreign shipment.

Large accumulations of manganese have been piled up in British India awaiting a market, it was brought out. Gold Coast production was described as potentially large at a lower figure than Russian ore. Mr. Adkerson asked the reason for the delay in developing the Gold Coast deposits and whether American steel companies controlled. He stated his complaint is only against Russia and does not involve these others. Mr. Doherty said that if Russia and all other foreign producers save one were excluded, the remaining one could meet American demands.

A statement was made by Mr. Adkerson to the effect that he had secured detailed costs of production, including wages and output per man, for the Czarist regime (1913), for the post-War period (1918-1925), and during the Harriman concession (1925-1928). He further stated that the output per man is less and the wages and other benefits are greater than before, meaning higher costs. Transportation and other known charges amount to 42c. per unit on 52 per cent ore, so that the sales price of 50c. obviously is below the cost of production and in direct violation of the anti-dumping clause, according to Mr. Adkerson's reasoning.

■

Mining Meet in Washington State Attracts 150

More than 150 person registered during the sessions of the Central Washington Mining Council, held at Wenatchee, Wash., on Sept. 4, 5, and 6. Edward Ferguson presided at the annual banquet at the Cascadian Hotel, attended by about 100 members and guests. The opening session on the first day of the meet was devoted to prospectors. In the afternoon a technical session was held. On the second day, mining activities in Washington were described as well as possible means of stimulating activity. O. B. Brown was elected president of the organization at the business session on Sept. 6. Other officers include A. H. Murdock, vice-president; C. A. Drinkard, secretary; and W. D. Shultz, treasurer. Near-by points of interest were visited by the members.

■

Enlarge Round Mountain Mill

Nevada Porphyry Gold, operating in the Round Mountain district of Nevada, is increasing mill capacity to 125 tons daily on a three-shift basis by the installation of ten additional stamps, two tube mills, and a Hardinge ball mill. The company was formed in 1928 to acquire several adjoining properties in the Round Mountain area in which T. F. Cole and L. D. Gordon had controlling interests.

The St. Eugene mill, near Moyie, B. C.

Dismantle St. Eugene Mill to Provide Big Missouri Plant

Consolidated Mining & Smelting is dismantling some of the machinery at its St. Eugene mill, at Moyie, B. C., and is shipping it to the Big Missouri mine, in the Portland Canal district. The St. Eugene mill has been idle since last fall, when it completed the work for which it was built —namely, the re-treating of the tailing from the old St. Eugene mill, which was burnt in 1916.

The tailing was cached in Moyie Lake. A suction dredge transferred it to the retreatment plant. As this work could not be continued during the winter, because of heavy ice, coarse-crushing machinery was added and the mill was also used to treat a large tonnage of dump ore from the Sullivan mine. When dumped, this material was considered to be too low-grade to be commercial, but subsequently, owing to improved milling practice, the company found it could be treated profitably. Because of surficial oxidation, it required different treatment than the freshly mined ore. Instead of being treated at the Sullivan mill, it was shipped to the St. Eugene mill, which has a coarse-crushing plant with a daily capacity of 800 tons and a fine-crushing and flotation capacity of 500 tons. Only part of this will be removed to the Big Missouri mine at present.

■

Sylvanite Gold Enlarges Mill

Following the example of the larger mines in the Kirkland Lake area of Ontario, and in keeping with its improved prospects, Sylvanite Gold Mines has stepped up the capacity of its mill from 200 to 260 tons per day. The increase has been accomplished by changes in the existing equipment, 3-in. balls having been used to replace rods in the rod mill, together with the purchase of another agitator.

■

Work Stopped at Silverado

Premier Gold has suspended exploration at the Silverado group, across Bear River from Stewart, B. C. The company acquired control of this property more than two years ago, and organized Silverado Consolidated Mines to take it over and develop it. A tunnel has been driven 1,000 ft. to open a shear zone at a depth of about 650 ft. and a good deal of drifting and raising has been done on the zone. This work indicates that the exceedingly attractive showing of high-grade silver at the surface, which attracted Premier to the property, does not persist to important depth.

■

Canadian Institute Visits Manitoba Properties

Visits to the Flin Flon and Sherritt Gordon mines, the two outstanding properties in northern Manitoba, were the feature of the annual Western meeting of the Canadian Institute of Mining & Metallurgy, which started at Winnipeg on Sept. 1 and ended at that city on Sept. 5. Members were accommodated on a special Canadian National train, which was their headquarters throughout the meeting.

A technical session was held at The Pas, at which papers were presented by W. A. Green, on the "History of the Development and Organization at the Flin Flon Mine"; by the staff of Sherritt Gordon Mines, on "Proposed Mining and Milling Practice at Sherritt Gordon"; by O. B. Gwillam, on "Leached Outcrops of Northern Manitoba"; and by H. F. Maulson, on "Mining Laws and Acts of Manitoba." C. H. Atwood, director of water power for the Manitoba government, spoke on the importance of power resources in the development of the mineral deposits of the province. R. H. Phelan, E. I. Brown, George Cole, Leon Dion, Dr. R. C. Wallace, and W. D. T. Jones were among the other speakers who addressed the meeting at various times. Prof. J. S. De Lury, president of the Institute, was chairman of the meeting.

■

Start Dome Mill in October

The new 1,500-ton cyanide mill under construction by Dome Mines at Porcupine, Ont., is scheduled to start about the last of October, just a year following the date on which the old cyanide-amalgamation mill was burned. Since production was halted the company has recovered about $500,000 in gold residues from the ruins of the old mill. Underground development work, which was pushed aggressively for some time, has recently been curtailed, pending completion of the mill. On the basis of the proposed capacity, the mine will have about four years' ore in reserve when production is resumed.

Mount Isa Adds to Length and Depth of Known Ore

Development work done at the Mount Isa lead-zinc property, in northern Queensland, Australia, has increased both the known length and depth of the main Black Star orebody and has brought reserves up from 28,000,000 to 30,500,000 tons of ore within the last four months. Total length of the orebody is at least 2,600 ft., and it continues to a depth of at least 1,200 ft. *In addition, the company has cut a total width of 35 ft. of copper ore in drilling on the Black Star orebody, the first time that it has been discovered in that particular section, although one hole near the Black Rock orebody cut 200 ft. of oxidized copper ore.

An auxiliary Diesel engine has been installed at the Mount Isa man-and-supply shaft, which has been connected with the Davidson shaft on the main haulage level. Driving is now in progress to connect with the main ore-hoisting shaft. Carbonate ore is being blocked out near these shafts, and at the Lawlor shaft blocking out of sulphide ore in the Rio Grande orebody has started.

Construction of metallurgical plants is progressing, more than 500 men being employed. The power house will probably be started in October, the mill in November, and the smelter in January, or about eighteen months after construction first started. The concentrate produced between the time of starting mill operation and blowing in of the smelter will be stacked for treatment, rather than shipped to other lead-smelting works.

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International Nickel to Explore Non-Producing Properties

International Nickel has plans for additional exploration to be undertaken this year on some of its older and partly developed properties, apart from those from which its nickel-copper production is now being obtained in the Sudbury district of Ontario. Officials state that because the company has now proved ore reserves of more than 200,000,000 tons, the object of the exploration program is not so much to enlarge these reserves as to find out the probable extent of the deposits, many of which have been only partly explored. Among the properties on which diamond drilling may be carried out this year are the Murray mine, with already proved reserves of 22,500,000 tons; Crean Hill, 3,089,000 tons; and Stobie, 13,712,000 tons. Recent drilling at depth in the Creighton mine has greatly enlarged the proved reserves of high-grade ore at this producing property, which at the end of last year stood at 5,503,000 tons.

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C. M. & S. Drills in Western Ontario

Consolidated Mining & Smelting has shipped a small compressor and drill equipment to Kashabowie Station, 60 miles west of Fort William, Ont., on the Fort Frances line of the Canadian National Railways, to be used in preliminary development and sampling of the Anderson property, optioned recently. Copper with some gold has been found in a body of sulphides on the claims.

Mining Men of Lake Superior Region Convene on the Mesabi

A. H. HUBBELL
Associate Editor

EVERY YEAR the Lake Superior Mining Institute visits one of the Michigan or Minnesota ranges at the time of its annual meeting. On each occasion, it is the guest of the mining men of the range or district that happens to be selected. Last year, the members saw the copper country. This year's meeting was held on the Mesabi, on Sept. 10 and 11, and, during it, the announcement was made that the 1931 meeting will take place on the Marquette range. Related to this decision, possibly, is the fact that at the recent meeting the members picked their new president from the iron-mining men on the Marquette. Their choice was S. R. Elliott, general manager of Cleveland-Cliffs Iron, who makes his headquarters at Ishpeming, Mich. Mr. Elliott succeeds John H. Hearding, assistant general manager of Oliver Iron Mining, at Duluth. The names of the remaining officers elected at this meeting are given elsewhere on this page. Because of the increasing duties of the secretary, the additional office of assistant secretary was created.

Agreeable to the members was the treasurer's report, stating that the year had been closed with the comfortable balance of $9,567.18. Also pleasant to consider was the increasing membership. Thirty-five new members were elected at the business session, bringing the total to more than 400. These facts are set down here to demonstrate the flourishing condition of the Institute.

FEW of the meetings and conventions that it has been my fortune to attend have equaled this get-together of mining men on the Mesabi. Nothing essential for an inspiring time was lacking: A crowd of metal-mine executives and engineers, most of whom knew one another, many of them born and bred in the region and graduates of its schools; the majority engaged in mining iron, thus having a further bond; a smaller group with interests in the Lake Superior copper country, but otherwise indistinguishable from the rest. This crowd reached its maximum size at the banquet, when almost 400 appeared, taxing the facilities. The hospitality of the hosts throughout was generous.

Newly Elected Officers of the Lake Superior Mining Institute, 1930-1931

President—S. R. Elliott, Cleveland-Cliffs Iron, Ishpeming, Mich.

Vice-Presidents for two years—E. J. Maney, Snyder Mining, Duluth, Minn.; O. D. McClure, Cleveland-Cliffs Iron, Ishpeming, Mich.; and R. A. Angst, Montreal Mining, Montreal, Wis.

Managers for two years—A. C. Hanson, Republic Steel, Negaunee, Mich.; and Abe Matthews, Pickands-Mather, Verona, Mich.

Treasurer—John E. Nelson, Republic Steel, Negaunee, Mich.

Secretary—A. J. Yungbluth, Cleveland-Cliffs Iron, Ishpeming, Mich.

Assistant Secretary—C. J. Staple, Ishpeming, Mich.

The papers of the program were practical, interesting, and so presented as to consume a minimum of time. And there were sights worth seeing—the great pits of the Mesabi, to describe which adequately calls for more ability than the average man possesses. Added to these elements were the scenery along the road, the joy of being outdoors, and the fun of being on a lark. All these combined to make the occasion memorable.

The meeting was a pilgrimage, starting at Duluth, where, roughly speaking, all except the Mesabi members assembled on Tuesday evening, Sept. 9. Early the following morning, they boarded a special train, which took them to Coleraine, at the Mesabi's western end, where their hosts met them with a fleet of automobiles. In these, the hosts and guests, at last united, sped swiftly eastward along the range, stopping now at some interesting open pit, now at some possibly still more interesting beneficiating plant, until they came to Hibbing, self-styled the "iron-ore capital," and with considerable reason. Here the annual banquet was held that evening, and the visitors spent the night. The special train had in the meantime moved up from Coleraine to provide the sleeping accommodations.

By car again, the following day, the members continued eastward along the range, visiting points en route and reaching the Eshquagama Club, 2 miles from Biwabik, at noon, when lunch was served and the annual business meeting held. Diversions characteristic of country clubs occupied the afternoon. With the return of the train to Duluth that evening, the meeting came to a close, all seeming quite contented.

The Trip Along the Range. At the western end of the range is the Canisteo pit, which long supplied the Oliver company's Trout Lake concentrator, dean of Mesabi washing plants. Down for several years, the pit has recently been unwatered, preparatory to operation by other interests. Brief visits were paid to it and to the famous washing plant.

Since the Canisteo's shutdown, the Trout Lake plant, near Bovey, has been running on the wash ores of other west end mines. At this washer, started in 1910, was developed the so-called standard Mesabi flow sheet (a trommel, two 25-ft. logs, four 18-ft. logs, and ten to twenty tables), which long remained unchanged but has been greatly simplified in the last six years by substitution of a bowl classifier for the 18-ft. logs and tables. Crushing equipment has been added to one unit. Although the plant is no longer taxed to full capacity, the tonnage handled per unit is far greater than before, owing to these and other changes.

A few miles further east, at Calumet, Minn., is the Hill-Annex pit, operated by Jones & Laughlin. At present, its ore is loaded by A. Guthrie & Company, contractors, using steam shovels and locomotives. This pit is to be electrified by Jan. 1, at which time the steel company will take over the entire operation. Thus far, in 1930, it has shipped more than 1,000,000 tons of merchant ore and concentrate, compared with 1,800,000 in 1929. The force is about 250 men, all being employed by the contractor save about 65.

NEXT to be visited were the "Rheolaveur" units installed at Butler Bros.' Patrick and Harrison plants at Cooley, as adjuncts to the older ore-washing installations. The two units are similar. That at the Patrick is working on the feed-rake product of the bowl classifier in the main plant, mostly minus-48 mesh material, with occasionally some log washer product (minus-¼ in.). Fed from a surge bin of a capacity sufficient for about 50 min. of operation, this material is lifted by bucket elevator to the first and topmost of a vertical series of five free-discharge Rheolaveur

The new president of the Lake Superior Mining Institute—S. R. Elliott, general manager, Cleveland-Cliffs Iron, Ishpeming, Mich.

John H. Hearding, the retiring president of the Institute. Mr. Hearding is assistant general manager of Oliver Iron Mining, Duluth

W. P. Chinn, general manager, Pickands-Mather & Company, Duluth

units (launders). These are respectively 14 in., 10 in., 10 in., 8 in., and 8 in. wide. Each launder has three successive zones lengthwise, each zone having its particular slope. The slope is important and depends on the specific gravity of the material washed and to a certain extent on size.

The feed is so delivered that it simply drops into the stream of "push water," flowing down the launder. Under proper conditions, the launder becomes a concentrator, the fine, heavy material flowing along the bottom, above it the coarse, heavy material, and on top the lighter. At intervals in the launder bottom are slots, with hydraulic boxes below them, through which a rising current of water may be introduced to break through the stream of fine, heavy material on the bottom and permit the coarse, heavy particles to fall. This rising current is used only on certain of the boxes, though it can be applied to any particular one. Thus it is possible to draw down through the slots a spigot product of either fine or coarse concentrate, the light material of the topmost stratum running over the end of the launder. The end discharge of the upper three launders constitutes the tailing. Spigots of the first launder discharge their products for re-treatment either into the second, third, or fifth launder below, depending on the grade of spigot product, or if the grade is high enough (as at times in the first five spigots), directly to the finished concentrate.

The spigots of the second launder discharge only into the third unit, the lighter material going into the tailing. Before escaping from the first and second launders, the tailing passes over a wedge-wire screen set in the bottom, through which a minus 0.25 mm. concentrate is taken out, which is sent back into the original feed to recirculate.

Spigots of the third unit discharge into the fourth, the launder overflow going either into the tailing or to recirculation. The fourth-unit spigots discharge either to finished concentrate or into the fifth launder, the overflow going to recirculation, as does the overflow of the fifth. The spigots of the fifth discharge a finished concentrate. Finished concentrate from the entire series is dewatered on a drag and returned to mix with the main plant concentrate.

When free-discharging, the spigots give a product of about 45 per cent solids. The tailing is pumped to the pond at about 10 per cent solids.

When the character of the feed changes, as frequently occurs, it is necessary to adjust the amount of push water, the rate of feeding, and the amount of concentrate drawn off. Such readjustment requires about 10 min. Results obtained in August, 1930 (according to M. P. Walle), on certain ore material, not typical wash ore, are as follows:

	Dried Iron	Silica
Feed to plant	46.05	26.64
Concentrate	56.25	12.72
Tailing	37.49	40.49
Recovery per cent, by weight	45.63	

NEXT to be visited was the Scranton open pit, at Hibbing, operated by White Mining (Pickands-Mather). This is one of the deepest stripping jobs on the Range, the company having stripped as high as 150 ft. The ore is low-grade and is practically all crushed before being shipped. This property long lay idle because of the grade of ore. An important tonnage still remains.

W. L. Tinker (right), secretary of the Lake Superior Iron Ore Association, Cleveland. Left, J. S. Wilson.

Three other pits were visited the second day—the deep Dunwoody, near Chisholm, producing direct-shipping ore, and, deepest of all, the Shenango, which is more than 400 ft. to the bottom. The latter is now operated by Snyder Mining. In its walls are to be seen some interesting folds. A small model illustrating the formation is on display.

The third pit was the great Missabe Mountain mine, U-shaped and roughly 2 miles long, with a production of 43,000,000 tons to its credit up to Jan. 1, and a record output of 6,500,000 tons in 1929. About 18,000,000 tons remains to be taken out before the lease expires in 1942, but this ore will come harder, as considerable stripping must be done. The company still has about 150 ft. to go in depth. About 70 per cent of the output is crushed, none of it being washed. Here about 250 men are working.

To facilitate the party's visit to this pit, a special train of three flat cars was provided by the Oliver company. Before returning, the party visited the Minnewas, another Oliver property. Once an underground mine, this is now being worked as an open pit. It is peculiar in that the ore formation is high on both sides, where ore is being mined, and low in the middle, where overburden still hides it. This mine is operated under a state lease and contains about 13,000,000 tons.

Sight-seeing concluded with a visit to the sintering plant of the Bruce mine, of Wisconsin Steel, near Chisholm. Sintering has for its purpose to remove the free and combined moisture, and improve the structure of the ore. Coke breeze is mixed with the ore in a pug mill, the mixture being then fed on to a Dwight-Lloyd sintering machine. The sinter is discharged directly into railroad cars.

The Banquet. The retiring president, John H. Hearding, presided at the banquet, which was held at the Androy Hotel, in Hibbing. In a short speech, he told of the organization of the Institute 37 years ago, when 40 men got together for the purpose.

A. Y. Peterson, vice-president and general manager, Oliver Iron Mining, alights from an airplane ride, at the Eshquagama Club

Half of these were dead and of the rest only two were present, himself and James MacNaughton. He urged the younger members to carry on and to adhere to the ideals of the Institute, as their predecessors had done.

Mr. MacNaughton, president of Calumet & Hecla, was then called upon to speak. He responded briefly, saying that the elements of a good speech were that the speaker should stand up to be seen, speak up to be heard, and shut up to be appreciated. He was thoroughly appreciated.

The Papers. E. E. Hunter, chairman of the subcommittee on papers, said that inasmuch as ore beneficiation and electrification were matters of major interest today, an effort had been made to get together for the meeting a series of papers dealing with them. The papers were then read by title, the authors in some cases giving a brief résumé of the contents. The papers were: "The Rheolaveur Method of Ore Beneficiation," by M. P. Walle; "Developments in Washing Mesabi Iron Ores," by Stanley A. Mahon and T. B. Counselman; "Crusher Installations of the Oliver Iron Mining Company," by F. E. Boyd; "Evergreen Mining Company's Sintering Experience," by P. G. Harrison; "The Year's Research on Iron Ore Beneficiation at the Michigan College of Mining and Technology," by A. T. Sweet; "Description of the Electric Power System Supplying the Iron Mines of Minnesota," by F. S. Rice; "Mechanical Shovels," by W. F. Schwedes; "Repair Shop Practice at Minnesota Iron Mines," by Anton Tancig; and "Amygdaloid Tailings," by R. N. Adams. A few others also were presented which had not been received in time for distribution.

In conclusion, I would cite one of the resolutions adapted by the members on the last day of the meeting. It professed a continuing faith in the value of the Institute for its work for the advancement of a broader knowledge and understanding of the problems of the various mining regions of the Lake Superior district.

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Official Report Shows Mining in Mexico Not So Bad

An official résumé of mining activities from Jan. 1 to Aug. 31, 1930, has been issued by the Department of Industry, Commerce, and Labor of the Mexican government, which shows that the mining situation is not so bad as has been reported. In that period, only ten important mines were closed and 26 major "readjustments" were made, which resulted in the discharge of 7,267 workmen of the 106,932 working in the mines at the beginning of the year. These figures do not include data on the closing of the Mazapil properties, which has occurred since Aug. 30.

The recent increase in the price of silver, slight though it is, has influenced the government to express the belief that the worst of the situation has passed. With this factor in view, permission has been given Dos Estrellas, large silver producer in the El Oro district, Michoacan, to reduce wages and lay off a certain number of workmen for a period not to exceed ninety days. The statement calls attention to the fact that a large proportion of the important mines are still working, even though most of them are not at full capacity. Reduction of freight rates and taxation in sections where complaints have been made is being considered.

Trend of the Times

THE marked lull in business activity this year at the end of August and the beginning of September has been followed by a general freshening of business sentiment as signs of seasonal improvement accumulate. . . . . Lengthened plant holidays and deferred check payments in the fortnight including Labor Day dropped the *Business Week* index to 83.5% of normal, despite evidence that business recovery, beginning as usual with the basic industries and primary distribution, is proceeding normally in response to seasonal stimulus. . . . . Coal and electric power production are increasing, steel output is being maintained, carloadings are rising. Expansion of commercial loans and currency circulation indicate a rising volume of wholesale and retail trade as the fall buying movement gets under way. . . . . Business is beginning to feel better than it looks, but is still stymied by undue caution in making forward commitments, which is keeping working supplies of raw materials and retail stocks of finished goods below normal requirements and consumer standards. . . . . If business initiative and Federal Reserve policy will take their foot off the brake and step on the gas at this time we can turn the corner without much danger of skidding.—From the *Business Week* of Sept. 17.

North Carolina Exploration to Operate Fontana Mine

North Carolina Exploration is the name of the company that has acquired the Fontana copper property, in Swain County, N. C., recently purchased from the Montvale Lumber Company. At present the Fontana mine is being operated under lease by Ducktown Chemical & Iron, which has been shipping ore to its smelter at Isabella, Tenn., but the lease expires in February, 1931.

Robert M. McConnell, an attorney of Knoxville, Tenn., is representing North Carolina Exploration, including the acquisition of other properties in Swain County. No plans for the development of the Fontana mine and other properties have been announced by North Carolina Exploration. It is understood that Ducktown Chemical & Iron Company has produced over 225,000 tons of high-grade ore from the Fontana mine since May, 1926. Local reports state that the new owners will expand the working of the property as soon as they obtain possession of it. Since North Carolina Exploration has no smelter, it will be necessary to sell the ore mined, or to construct concentration plants as soon as conditions justify this step.

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M. E. Lake Options Metcalf Mine

M. E. Lake has obtained an option on the properties of United States Copper, near Metcalf, in the Morenci district of Arizona. The company's holdings consist of three groups with a total area of 1,380 acres. If the option is exercised, the purchase price will be $300,000.

■

Surface Exploration at Bodie

A Bucyrus-Erie gas-air shovel of 1-cu.yd. size is being installed at Bodie, Calif., by Treadwell-Yukon for trenching work. Exploration work is in progress underground and detailed surface exploration for gold veins hidden by surface débris will be effected by trenching.

Nevada Quicksilver Buys California Properties

Nevada Quicksilver, one of the largest producers of quicksilver in Nevada, has purchased the Cloverdale and Beaumeister mines near Cloverdale, Sonoma County, Calif., and is negotiating for purchase of a third property in the district. L. A. Friedman, president of the company, is credited with the intention of making Nevada Quicksilver the largest factor in the American quicksilver industry. A 100-ton Gould rotary furnace is treating about 50 tons of ore daily at the Cloverdale mine at present. A new compressor and 7,000 ft. of air line have been installed. Twelve machine drills are being worked two shifts.

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Kirkland Lake Gold Grade Up

An improved grade of ore has been opened up in the lower level workings of the Kirkland Lake Gold mine, at the western end of the producing section of the Kirkland Lake district of Ontario. Drifting at a depth of 3,875 ft., a total length of 750 ft. has been opened up in two veins situated on the footwall and hanging wall, respectively, of the main ore zone. Treating an average of about 150 tons of ore per day, with recovery averaging about $12.50 per ton, August production from the mill was about $55,000.

■

Silver Find Made Near Gowganda

Castle Trethewey Mines has encountered a new 3-in. high-grade vein on ground recently acquired on the property formerly owned by Capitol Silver Mines, near Gowganda, Ont. The discovery was made in an exploration crosscut driven out from a shaft on the Capitol property at a depth of 800 ft. Last year, in accordance with an agreement with Capitol shareholders, the shaft was reconditioned and an electrically driven plant, consisting of a 1,100-cu.ft. air compressor, double-drum hoist, and drill equipment was installed.

United Vanadium Testing Ore in Mill Near Wickenburg

Additional machinery is being installed by United Vanadium in its 25-ton pilot plant in the Dripping Springs district, near Wickenburg, Ariz. Operations are being conducted with the intention of evolving a flow sheet for a new and larger mill, should mine development now being done justify large-scale operations. The vanadium occurs in lead vanadate, disseminated through a diabase dike, 100 ft. thick, and intruded into limestone beds. The pitch of the dike is 45 deg. Ore occurring along the contact between the limestone and the dike is of better grade, but, because it occurs in scattered deposits, the company intends to block out the ore in the dike first. The contact deposits will be explored later. Two tunnels, 100 ft. apart vertically, have been driven and crosscuts are being put out at 50 ft. intervals to cut the deposit. Ore can probably be mined by caving methods.

At present, mill heads from development work run 0.88 per cent V_2O_5, from which a 10 per cent concentrate is being made. Ore is crushed in a jaw crusher; ground dry in a small ball mill, operating in closed circuit with a 16-mesh Cottrell vibrating screen; and concentrated on to Deister Plat-O tables. Middling from the tables is sent through a Braun pulverizer, adjusted to crack or unlock the ore crystals from the accompanying gangue rather than to pulverize the minerals. Power is now supplied by a 40-hp. Fairbanks Morse engine.

The new equipment includes a 150-hp. Diesel engine, a 120-hp. generator, a 3½x8-ft. Marcy rod mill, and a 12x14-in. Blake crusher. Ore will be ground wet in the Marcy mill instead of the present dry grinding in the ball mill. From present indications, the flow sheet for the new mill will include successively finer cracking of the table middling followed by flotation or tabling until the last middling material is nearly all minus 200 mesh.

About 30 men are now employed by the company. A school and new residences are being built. G. Naddeo is in charge of operations and C. L. Vance is metallurgist.

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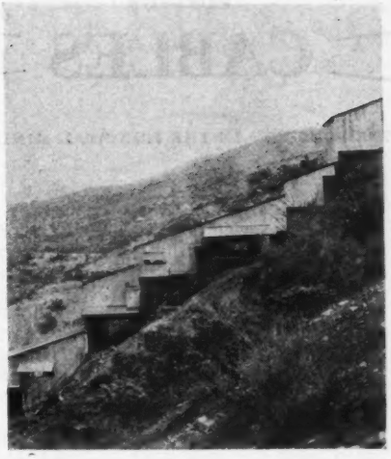
To Sink Eureka Standard Shaft

Sinking of its main shaft to the 1,400 level is planned by Eureka Standard, operating in the Tintic district of Utah. The shaft is now bottomed at 1,300 ft., and results of development at that depth have been favorable. About nine carloads of ore running about 1.2 oz. of gold to the ton, as well as copper and silver, is being shipped from the property weekly. The company has just declared its initial dividend of 3c. a share. Tintic Standard holds 90 per cent of the outstanding stock.

■

Explore Claims Near Auburn, Calif.

Eldorado Gold Mines, Ltd., is exploring a group of mining claims on the American River, east of Auburn, Calif. S. H. Brady is in charge of the work and plans to sink a shaft after the completion of preliminary surface work.



Pilot mill of United Vanadium

Raise Tonopah Custom Rate; Extension Output Higher

Beginning Sept. 16, rates for milling custom ore at the Tonopah Mining mill at Millers, in the Tonopah silver-gold district of Nevada, were raised from $4.50 to $5.50 a ton, according to an official announcement by H. A. Johnson, superintendent of the company, who stated that only by this move could operation of the plant be continued. It has been handling only custom ore for some time. Tonopah Extension, which controls the only other operating mill in the district, is showing a slight increase in bullion production from its own ore.

Tonopah Mining suspended work at its mine several months ago because of the drastic drop in the price of silver. At the time, the company stated that ore was still in sight in the mine, but that it was deemed better business policy not to mine it until an advance in the price of silver. The Millers plant is the only custom mill in the district.

Production by Tonopah Extension in August was 126,900 oz. of silver-gold bullion, valued at $65,200. Of this total, 69,680 oz., valued at $36,000, was produced in the second half of the month. John C. Kirchen, general manager of the company, states that the 1,800 level will be unwatered as soon as additional pumps have been ordered and installed. A large orebody has been opened on the 1,600 level in ground that has not been explored at 1,800 ft., and development at the greater depth will be directed toward this area.

■

Prepare for Tucson "Revival"

Preparations for the Arizona Mining Revival meeting, to be held in Tucson, Ariz., on Oct. 31 and Nov. 1 and 2, have just been completed by the local Chamber of Commerce. The meeting is the fifth of a state-wide series, with the purpose of bringing together prospectors, small mine operators, mining-company representatives, and business men, to discuss non-technical mining problems and general mining development—to stimulate interest in the future of mining and its relation to the State of Arizona. Previous meetings, sponsored by the Arizona Industrial Congress, American Mining Congress, and Arizona section of the A.I.M.E., have been held in Yuma, Nogales, Prescott, and Kingman in the last two years.

Start Work on Construction of New Jack Waite Mill

Construction of the new 500-ton lead-zinc flotation concentrator for Jack Waite Mining, at its property in the eastern section of the Coeur d'Alene district of Idaho, has been started. This plant will supplant the 125-ton unit now in operation, built by Jack Waite Consolidated, the predecessor company. The new plant will have a crushing capacity of 1,000 tons daily with a No. 10 Traylor crusher, which will reduce all feed to ½-in. size. The flotation section will have a capacity of only 500 tons daily for the present, but it will be built so that addition of another Hardinge conical ball mill and 20 flotation cells will bring capacity up to 1,000 tons daily. W. L. Zeigler, mill superintendent of Hecla Mining, is superintending construction, which is expected to be completed by Feb. 1.

The branch railroad that serves Jack Waite is being extended to within 2 miles of the property by laying 2½ miles of additional track. The company has not yet decided whether it will bridge the remaining gap, because of the grade, which would make construction and operation expensive. Tailing from the new mill will be flumed down Tributary Creek to comparatively level ground at the junction with Eagle Creek, where it will be impounded to prevent contamination of the water.

Underground, a three- or four-compartment shaft will be sunk from the haulage tunnel to permit mining at depth; a raise will be put up 400 ft. to connect with the tunnel driven from the Montana side of the divide; and the main drift will be continued in ore. A new compressor of larger capacity will be installed to provide air for this work. The present light power-transmission wire is being replaced by the Washington Water Power Company to permit transmission of more power to the mine. Three single-phase transformers will bring the mine's potential power supply up to 1,000 hp.

■

Villemagne Improves at Depth

Development of the lowest level of the Villemagne zinc-lead mine, in southern France, has proved the vein to be much wider than on upper levels. Drifting on the footwall side of the vein has followed ore 10 ft. wide for 300 ft. On the hanging-wall side, ore has been followed for 170 ft., averaging 8 ft. Two crosscuts have been driven through the vein to date, showing a further width of 16 ft. of mineralized ground, thus making the total 34 ft. Diamond drilling has indicated similar ore 100 ft. deeper. Ore reserves so far proved are nearly 4,000,000 tons. Production is now about 500 tons daily. Mining Trust controls Villemagne.

■

Reopen Grass Valley Gold Mine

In the Grass Valley gold district of California, the Mayflower property, at Canada Hill, has been reopened by Shenandoah Gold Mining under the leadership of H. A. Hood. The property consists of 149 acres, southeast of Nevada City. Production in the past was obtained from a small stamp mill.

EXCLUSIVE

CABLES

FROM CORRESPONDENTS IN THE PRINCIPAL MINING CENTERS

Lease Area at Sub Nigel Is Developing Well

Johannesburg, Sept. 16.—Development work done in the lease area of the Sub Nigel property, near Heidelberg, southeast of the Witwatersrand, is understood to be showing very high-grade ore, even for this mine. Sub Nigel ore has an average grade of about 18 dwt. per ton, compared with 10 dwt. per ton at the Modderfontein Deep, the highest grade mine on the Witwatersrand proper. The development work in the lease area at Sub Nigel is opening up new ground between the Betty shaft, recently completed, and the older workings near No. 1 shaft. A further drop in working costs is anticipated as a result of the completion of the major part of the development program. In July, they averaged 39s. per ton, compared with 39s. 8d. in June and 41s. 5d. in April. In addition, the ore reserves at the end of June were estimated at 965,000 tons of an average value of 18 dwt., an increase of 43,000 tons in the last six months. Production is about 1,000 tons of ore daily.

. . . . Discovery of a new reef in the footwall of an old stope above the No. 7 level at the New Kleinfontein property, on the Far East Rand, is very encouraging to the operators of this low-grade mine. Work done on the discovery to date shows the reef dipping steeply into the underlying measures. The grade of the ore is moderately good. Exploration is being pushed by the management, but as yet too little has been done to judge the possibilities. New Kleinfontein has been on the verge of closing down for several months, not because of lack of ore, but because the extremely low grade has made operation unprofitable. In June, the average grade of the ore handled was only 4.28 dwt. per ton, the lowest on the Rand. Operating profit from the treatment of 51,800 tons of this grade was only £3,032 on a capital of £1,151,540. Virtually all development work had been eliminated, preliminary to complete suspension, when the new reef was found.

. . . . The most encouraging feature on the whole Witwatersrand at present is the revival of interest in the West Rand section, which has been fairly dormant for years. A marked improvement has taken place in the demand for shares of Randfontein, West Rand Consolidated, and Luipaard's Vlei Estate. Installation of three new tube mills at the latter property has raised capacity from 600 to 1,000 tons of ore daily. To bring hoisting capacity up to this figure, the main shaft has been converted to a two-stage hoisting unit. At Randfontein, sinking of the North Deep shaft to the 4,500 level is being pushed at the rate of 250 ft. monthly. The shaft is now down about 2,700 ft.

■ ■ ■

London Metal Traders Believe Tin Stocks Are at Peak

London, Sept. 18—Although visible supplies of tin increased again in August, metal traders here are inclined to believe that the worst of the statistical position is now over and that hereafter the effects of the curtailment of production will be reflected in the stocks. The increase in August—about 1,600 long tons, to a total of 43,518 long tons—was rather larger than had been anticipated. Two Malayan tin-dredging companies, with a combined output last year of about 800 tons of tin concentrate, have decided to suspend operations completely for six months because of the unremunerative price of the metal.

. . . . The agreement of Transvaal platinum producers to keep the price of that precious metal at £8 to £8 10s. has been unsuccessful, though precisely why the effort failed, no one seems to be able to say, but undoubtedly the chief cause is the combination of new production with underconsumption. Sales by the Soviet government are blamed by some for the recent slump. They state that Russia is anxious to dispose of its platinum in order to establish credits in countries where it desires to purchase equipment and has been dumping the metal regardless of price. Others, however, feel that the increasing production from the Frood property of International Nickel, which carries considerable quantities of the platinum metals in its copper-nickel ores, is responsible, since it is entirely a byproduct. In some quarters talk is heard of the price falling to £4 10s., or about the price of gold.

. . . . Ore reserves at the Mount Isa lead-zinc property, in Queensland, Australia, have been re-estimated at 30,500,000 tons, mostly sulphide. The first unit of the plant, milling 1,500 tons of ore daily, is due to start in November, to be followed by the smelter in January. Because of the large interest that American Smelting & Refining has acquired in Mining Trust, the controlling factor in Mount Isa, the stockholders have been asked to vote on a proposal to remove restrictions on foreign shareholders.

. . . . Solly B. Joel, chairman of Johannesburg Consolidated and director of De Beers Consolidated, in an interview admitted that there have been differences of opinion between the South African government, the diamond producers, and the diamond-marketing syndicate because of the fact that the government has been overselling its quota of alluvial stones.

. . . . American Smelting & Refining, which already has mining interests in the Balkans, is represented on a party of geologists now engaged in investigating the mining resources of Bulgaria. A two-years' option has been secured.

. . . . A large area in northern Spain has been delimited by the Spanish government and registration of mining claims within it has been suspended. State exploitation of extensive potash deposits, recently discovered in this district, will probably be undertaken.

■

Three Rhodesian Mines Center Activities on Construction

London, Sept. 19.—Three of the Rhodesian copper mines—N'Kana, subsidiary of Bwana M'Kubwa, which has 80,000,000 tons of ore in sight and is building a 10,000-ton mill; Roan Antelope, of the Rhodesian Selection Trust group, which is commonly credited with 100,000,000 tons of ore and is well on its way to starting production with the first 5,000-ton mill unit; and Mufulira, of the same group, which has delimited at least 60,000,000 tons of ore and is building a 6,000-ton concentrator—are now centering their activities on construction and have virtually ceased active exploration work, although the ore possibilities of their holdings have not yet been thoroughly checked. The three other principal companies operating in the extreme north of Northern Rhodesia—N'Changa, Rhodesian Selection Trust, and Rhodesian Congo Border Concession—continue intensive development work, largely through diamond drilling.

. . . . R. C. B. C. has just completed boreholes NE 29 and NE 40, the latter in the Chingola area, two miles west of the main R. C. B. C. deposit. Neither cut ore, although both holes proved valuable in revealing the geology and outlining the deposits. Borehole NE 21A, put down near the southern border of the high-grade N'Changa West Extension orebody, has cut about 45 ft. of ore that will average more than 4.5 per cent copper, starting at a depth of 565 ft. Hole NE 29 lies about 3,000 ft. to the west of NE 21A.

. . . . Roan Antelope set a new record for opening work at its mine in August. A total of 3,882 ft. of lateral work was done. Similar progress is being made in mill construction. Five ball mills have already been set. Originally expected to start production in 1932, it now seems likely that the company will be turning out copper concentrate by the end of 1931.

. . . . Rhodesian Selection Trust is planning to sink a shaft at its Chambishi property, the principal deposit it still holds under the terms of the N'Kana Concession. Further drilling will also be done. At least 25,000,000 tons of ore of better than 3 per cent grade has been proved.

. . . . Luiri Gold, sole gold producer in Northern Rhodesia, reports an August output of £2,028. This is much lower than the average of recent months, which has been well above £3,000.

MARKET AND FINANCIAL NEWS

Lead Production Increased in U. S. During August

Production of refined lead in the United States during August totaled 58,036 tons, an increase of 1,832 tons over the July figure. Shipments showed a moderate decline for August, owing to the general decline in business activity for that month. Stocks increased to the extent of 9,952 tons, according to the American Bureau of Metal Statistics. Battery makers absorbed more lead in August than in the preceding month, but a decline in shipments was reported by cable companies, manufacturers of sundries, and jobbers.

Statistics for July and August, in tons, follow:

U. S. Stocks and Shipments

Production:	July	Aug.
From domestic ore	51,538	52,980
Secondary and foreign	4,666	5,056
Total production	56,204	58,036
Stock at beginning	55,501	62,880
Total supply	111,705	120,916
Stock at end	62,880	72,832
Shipments by difference	48,825	48,084
Shipments reported	48,816	47,979

Production from Domestic Ores

	1929	1930
January	63,165	49,991
February	55,546	54,125
March	61,110	56,552
April	58,040	55,547
May	63,632	52,818
June	58,380	50,721
July	59,155	51,538
August	58,503	52,980
Monthly average	59,737	53,035

■

Stocks of Refined Copper Largest Since 1921

Total stocks of blister and refined copper in the hands of North and South American producers on Sept. 1 amounted to 581,823 tons, an increase of 17,572 tons over the figures for the preceding month. Stocks of refined were up 25,649 tons, the increase resulting largely from the slow movement of copper into consuming channels. Combined domestic and foreign shipments of refined metal during August, according to the American Bureau of Metal Statistics, were 95,129 tons, against 117,902 tons for the month of July, and 142,005 tons in August, 1929. The stocks of refined copper are the largest since the summer of 1921.

Production of refined copper in North and South America in August totaled 120,778 tons, a decrease of 2,401 tons from the July level.

Stocks of copper at the beginning of July, August, and September, in tons, follow:

	July 1	Aug. 1	Sept. 1
No. and So. America:			
Blister (a)	253,834	242,212	234,135
Refined	316,762	322,039	347,688
Total	570,596	564,251	581,823
Great Britain (b):			
Refined	2,147	1,733	2,742
Other forms	5,825	5,333	4,999
Total	7,972	7,066	7,741
Havre	6,972	7,868	6,614
Japan	10,463	.....	.....

(a) Includes stocks at smelters, quantity in transit, stocks at refineries, and quantity in process at refineries. (b) Official warehouses only.

Distribution of U. S. copper production in July and August:

	July	August
Porphyry mines	20,633	20,956
Lake mines	6,354	6,545
Vein mines	22,562	24,278
Custom ores	4,700	5,000
Total crude production	54,249	56,779
Daily rate	1,750	1,832
Imports in ore and matte	6,983	.....
Smelter production	67,638	66,898

■

World Copper Output Up

World copper production in August totaled 148,321 tons, compared with 143,615 tons in July, according to the American Bureau of Metal Statistics. The following table gives in short tons the world output for June, July, and August, based on smelter reports, without segregation as to the country of origin of the ore:

	June	July	August
United States	69,155	67,638	66,698
Mexico	5,371	4,968	4,812
Canada	11,005	11,820	12,950
Chile and Peru	23,043	23,328	26,937
Japan	7,895	7,365	7,314
Australia	2,487	496	510
Europe (a)	15,541	16,000	16,500
Elsewhere	11,300	12,000	12,700
World total	145,797	143,615	148,321

(a) Partly estimated.

■

Copper Dividends Passed

Calumet & Hecla Consolidated and Copper Range, two of the producing companies in the Michigan copper district, have passed their dividends for the third quarter of 1930 as a result of the drop in the price of copper, which has virtually eliminated the margin of profit from the comparatively high-cost "Copper Country" mines. C. & H. last quarter paid a dividend of 50c. a share, after having cut the rate from the former payments of $1 quarterly. Copper Range paid a dividend of 25c. a share in the second quarter, compared with former payments of 50c. quarterly.

August Silver Output in U. S. Down From 1929 Level

Silver produced in the United States during August amounted to 3,749,000 oz., against 3,551,000 oz. in July, and 5,006,000 oz. in August last year. Canadian production in August was 2,685,000 oz., against 2,100,000 oz. in July, and 2,744,000 oz. in August, 1929, according to the American Bureau of Metal Statistics. Output of silver in Peru for August totaled 1,550,000 oz., which compares with 1,480,000 oz. in the preceding month, and 1,907,000 in August last year. Australian production was 989,000 oz. in August, against 897,000 oz. in July, and 955,000 oz. in August, 1929.

Latest production statistics for Mexico cover the month of June and reveal an output of 10,276,000 oz. for that period. This compares with 9,080,000 oz. in May, and 8,386,000 oz. in June, 1929.

Burma produced 580,000 oz. in July, against 610,000 oz. in June, and 581,000 oz. in July, 1929.

June is the latest month for which complete production statistics are available. World production for June totaled 18,607,000 oz., comparing with 18,237,000 oz. in May, and 17,802,000 oz. in June of last year. Production of silver during the first half of 1930 amounted to 108,890,000 oz., against 102,120,000 oz. in the same time last year. The gain in production over last year is due chiefly to the larger output of Mexican mines. Early in 1929 Mexican output was sharply curtailed because of political disturbances.

■

N. Y. Mining Exchange Opens

Beginning operations with a trading list of about sixty issues, the New York Mining Exchange opened for business on Sept. 10 at 80 Wall St. Transactions on the first day aggregated about 8,000 shares.

Guests at the opening included representatives of other exchanges, visitors from Stock Exchange houses, and several mining men. A feature of the opening ceremonies was an address by H. C. Hicks, president of the new exchange, who emphasized that no stocks would be dealt in which are listed on the Stock Exchange or the Curb in New York. Only meritorious issues of exchanges outside of New York will be listed, he said.

Mining Company Dividends for September, 1930

Companies in the United States	Situation	Per Share	Total Disbursements
American Metal	Various	$0.37½Q	$325,569
American Metal, 6% pfd.	Various	1.50 Q	103,014
American Smelting & Refining, 6% pfd.	Various	1.57 I	274,000
American Smelting & Refining 7% pfd.	Various	1.75 Q	875,000
Bunker Hill & Sullivan, s. l.	Idaho	0.50 MX	245,250
Castle Peak, q.	Nevada	0.50	10,000
Eureka Standard, g. s.	Utah	0.03 I	45,000
Federal Mining & Smelting, pfd.	Idaho, Okla.	1.75 Q	126,000
Golden Cycle, g.	Colorado	0.40	66,000
Hecla Mining, l. s.	Idaho	0.25 Q	250,000
Iron Cap Copper(*b*)	Arizona	0.15 Q	24,315
Homestake Mining, g.	S. Dakota	0.50 M	125,800
Mayflower Associates, h.	Various	0.50 (*a*)	150,000
National Lead	Various	1.25 Q	387,289
National Lead, pfd. "A"	Various	1.75 Q	426,433
Nevada Consolidated Copper	Nev., Ariz., N. M.	0.25 Q	1,214,312
St. Joseph Lead	Various	0.75 QX	1,463,647
Sunshine Mining, s. l.	Idaho	0.03 Q	45,000
Utah Copper	Utah	2.00 Q	3,245,990
Companies in Other Countries			
Chile Copper	Chile	0.62½	2,759,689
Hollinger Consolidated Gold	Ontario	0.05 M	246,000
International Nickel, n. c.	Ontario	0.25 Q	2,947,161
Lake Shore, g.	Ontario	0.30 Q*a*	300,000
Lucky Tiger, g. s.	Mexico	0.025 M	17,883
McIntyre-Porcupine, g.	Ontario	0.25 Q	199,500
Total			$15,827,852

s, silver; l, lead; c, copper; n, nickel; g, gold; q, quicksilver; h, holding company; Q, quarterly; M, monthly; I, initial payment; X, extra; (*a*), plus bonus; (*b*), paid in August, omitted from our last list.

Extent of A. S. & R. Holdings in Mining Trust Indicated

In the first annual report of Mining Trust, British holding company with interests in non-ferrous metal mines in Australia, New Guinea, and France, an indication is given of the amount of its stock held by American Smelting & Refining, which has recently signed an agreement to provide Mining Trust with technical advice and direction in the development of the latter's properties. The report states that 1,245,988 shares have been issued under arrangements made with American Smelting & Refining, bringing the total number of shares of £1 par now outstanding up to 5,745,988 shares, with 32,500 shares under option at par until June, 1931. A.S.&R., therefore, has slightly more than 20 per cent of the outstanding stock. A net profit of £34,505 was made in the first year, ending June 30, 1930.

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Tri-State Concentrate Agency Acquired by L. H. McColgin

L. H. McColgin, of Joplin, representative of the late R. C. Allen Zinc Sales Agency, has salvaged the wreckage of the Allen agency and established himself as an agent for the disposal of zinc concentrates in the Tri-State district. Mr. McColgin has announced that approximately 50 per cent of the Joplin district production has signified its intentions of selling through his agency.

The Allen agency contracts, which were to run another seventeen months, have been returned, where requested, and those remaining will be returned as soon as possible.

Several of the companies which had actively supported the Allen agency are backing McColgin. The largest support is coming from the representative of one of the largest producers, who is also interested in zinc-smelting operations.

Charges by the McColgin agency will be 10c. a ton, which compares with 30c. formerly charged by Allen.

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Financial Notes

ENGELS COPPER, operating a property in California, reports a net loss, before depreciation and depletion, of $38,917 in the first six months of 1930. Copper production was 3,817,997 lb., compared with 5,761,522 lb. in the first six months of 1929. The mine has since been closed.

SENECA COPPER, operating a property in Michigan, reports a net loss, after all charges, of $250,686 in the first half of 1930, of which $136,884 was incurred in the second quarter. Loss before depreciation and depletion was $163,817 for the first half of 1930, compared with $79,454 in the first half of 1929.

BALATOC MINING, operating a silver-gold property in the Philippine Islands, reports a net profit of 464,794 Philippine pesos in the first half of 1930, from a production with a gross value of 1,186,985 Philippine pesos. A total of 24,365 tons of ore was treated during the period. The company paid a dividend of 5 centavos a share on June 30.

AMULET MINES, operating a copper-zinc property in the Rouyn district of Quebec, reports a net profit of $20,043 in the course of operations from April 15 to June 30. Production at the property started on April 15 and copper and zinc concentrates valued at $134,931 were produced. Operating profit was $61,536.

FRESNILLO COMPANY, operating silver-lead-zinc properties in Zacatecas, Mexico, reports an operating profit of $148,202 in the second quarter of 1930, compared with $422,120 in the second quarter of 1929. Production was virtually unchanged, but the drop in the price of metals severely affected profits despite a decline of about 70c. a ton in working costs. The oxide unit operated at a loss in June.

KERR LAKE MINES, which owns a silver mine in Ontario as well as the Rimu gold-dredging property in New Zealand, reports a profit of $4,829 in the year ended Aug. 30, 1930. The silver mine is now worked by lessees. Production of gold from New Zealand was 6,292 oz. for the first seven months.

BUNKER HILL & SULLIVAN, operating a lead-silver property in Idaho, reports a profit of $188,152 in July, before depreciation and depletion. For the first seven months of 1930, profit before depreciation and depletion was $1,550,669.

ALASKA JUNEAU, in August, 1930, mined and trammed to mill 353,850 tons, from which estimated receipts were $296,500, or 83.79c. per ton; operating expenditures totaled $185,000, or 52.28c. and operating profit $111,500, or 31.51c. per ton. Other expenditures and accrued charges were $10,100, leaving a surplus of $101,400 for the month.

Complete Market News and Prices

THE semi-monthly magazine you are now reading carries only a condensed review of important market news and price movements. For buyers and sellers of ores, metals, minerals, and scrap who require reliable information as soon as it is available, we now provide *Metal and Mineral Markets*, which goes to press at the close of the metal-market week each Wednesday. It is printed at high speed and is in the mails that evening. In compact form, ready for insertion in a ring binder, it is ideal for desk and reference use. It carries the standard *E.&M.J.* quotations used in contracts the world over, recognized as authoritative and dependable. *Metal and Mineral Markets* is priced to subscribers in the United States and its possessions at $2 per annum; to countries in the Americas but outside the United States, $5; elsewhere, $10 yearly: 52 issues. Address *M.& M.M.*, 36th St. and 10th Ave., N.Y.City.

Copper Price Reduced ¼c.—Lead and Tin Steady—Silver Demand Improves

New York, Sept. 18, 1930.—Under the pressure of heavy stocks and a continuance of moderate buying, copper developed further weakness in the last two weeks, and actual business was placed as low as 10½c., delivered Connecticut, a decline of ¼c. The latest reduction brought the price down to the lowest point reached since January, 1902. Demand for lead was only fair, but shipments appear to be on a slightly larger scale than in August, and, despite the unsettlement in the London market, sellers maintained prices on a steady basis throughout the period. Trading in zinc broadened somewhat without making any impression so far as prices were concerned. The market for tin held about steady on reports to the effect that production in the East has been curtailed. Demand for silver has improved, and the price advanced toward the close. Lower quotations obtained for both platinum and quicksilver. There was little change in the position of antimony.

Copper Depressed

The movement of copper into consuming channels has not improved sufficiently to bring out any change for the better. August statistics confirmed the general impression that shipments during that month fell off sharply. Stocks of refined copper in the hands of North and South American producers increased during August to the extent of 25,649 tons. World production statistics for August also were disappointing, in that the output increased 4,706 tons over the July figure. The decline to 10½c., delivered Connecticut, resulted in only a fair volume of new business. Few consumers appeared willing to take on additional copper under prevailing general business conditions. As previously noted, most fabricators have enough copper, either booked or on hand, to carry them over into December, unless business should take a decided turn upward. Because of this situation some sellers had to offer copper for delivery as far ahead as next February in order to bring out new business. Export sales in the first half of September amounted to about 15,000 long tons. On Sept. 16 Copper Exporters, Inc., reduced the c.i.f. basis to 11.05c.

Zinc Demand Improves

Though demand for zinc showed improvement, the buying was not up to expectations. Both galvanizers and the brass mills are a little more active than in August. Stocks on Sept. 1 were extremely heavy, amounting to 122,635 tons, against 49,064 tons on the same date last year. Toward the latter part of the period under review, offerings of Prime Western zinc at 4.25c., St. Louis, were quite liberal. Prime Western concentrate settled at $32 per ton in the Tri-State district, an advance of $1.

Lead Sales Moderate

Sellers of lead in the Eastern market held the price at 5.50c., the contract basis of the American Smelting & Refining Company. The principal sellers in the Middle West did business at 5.35c., St. Louis, though an occasional lot of chemical lead was sold in other directions at 5.30c. Demand for lead has been moderate so far this month, but as shipments, against contracts have improved somewhat the tone of the market has been fairly steady. Weakness in the London market toward the close resulted in a little uneasiness here, although the lower prices abroad were largely in sympathy with copper.

Lead concentrate in the Joplin market has shown little change, the offers on 80 per cent lead content holding at $65 per ton. Sales have been less than production. Reserves are now estimated at 12,600 tons.

Tin Steady

Except for a better tone in the market following receipt of reports to the effect that production in the East is definitely downward, there was little change in the situation. Buying was moderate. The price held close to 30c. for prompt Straits, with the usual premium of about ⅛c. a month on futures.

Silver Inquiry Better

Improved conditions in China, and buying from quarters which have been more or less bearish on the metal for some time past, brought out a better feeling in the market for silver. The New York price reached a level which has not been touched since last May. The tone at the close was steady.

Other Metals

Quotations cover wholesale lots, f.o.b. New York, unless otherwise specified. London prices are according to latest mail advices.

ALUMINUM—Per lb., delivered, Alcoa commercial and mill ingot, 99 and 98 per cent, 23.30c.; Alcoa No. 12 alloy, 22c.; metallurgical ingot, 94 per cent plus, 23.30c.; 98@99 per cent, 22.90c. London unchanged at £95, less 2 per cent, per long ton, for 98 per cent ingots and bars.

ANTIMONY—Per lb., duty paid, Chinese, spot, 7¾c.; futures 7⅞c. Cookson's "C" grade, spot 12⅞c. "C.M.C." grade, 99.9 per cent, spot, 10¾c. London, Chinese, spot, £27 per long ton.

BISMUTH—Per lb., in ton lots, $1. London, 4s.

CADMIUM—Per lb., 70c. London, 3s. 3d.

CHROMIUM—Per lb., 97@98 per cent grade, 85@90c. per lb. contained chromium, maximum 1 or 2 per cent iron.

COBALT—Per lb., delivered: Metal imported from Belgium in the form of rondelles, 97@99 per cent, spot, $2.50. Discounts on contracts. Quiet. London, spot, 10s.

INDIUM—Per gram, minimum 99 per cent, $14@$15.

IRIDIUM—Per oz., $190@$200 for 98 @99 per cent sponge and powder. London, £42.

MAGNESIUM—Per lb., 12-lb. ingots (4x4x16 in.), 99½ per cent, 65c.@$1, depending on quantity; 2½- or 3-lb. sticks (1⅜ in.), 70c.@$1.05, depending on quantity. London, 2s. 9d.@3s. for 99 per cent ingots or sticks.

MANGANESE—Per lb. contained manganese, 95@97 per cent, 42c.

MOLYBDENUM—Per lb., in 50- to 100-lb. lots, C.P. powder, $9.50; 97 per cent, $6.50. (Usually sold as calcium molybdate or ferromolybdenum, which see.)

NICKEL—Per lb., ingot, 35c.; shot, 36c.; electrolytic, 35c. (99.9 per cent), for single lots of spot metal. Contracts, 30@33c. London, per long ton, £170@£175.

OSMIUM—Per oz., $60@$70. Nominal. London, £15½.

PALLADIUM—Per oz., $19@$23. London, £3 15s.@£4.

PLATINUM—Per oz.: Official price of leading interest was reduced from $36 to $34 on Sept. 17. Cash transactions between dealers and refiners at several dollars less. London, £7, with lower prices reported in the open market.

Columbian crude platinum, basis 85 per cent platinum content: Average price for August was approximately $27.50 per oz.

QUICKSILVER—Per 76-lb. flask, $110 @$115, delivered. Nominal. London, £22⅝.

RADIUM—Per mg. radium content, $50 in lots of 4 grams or more, to $65 for 1 gram; smaller quantities, $70.

RHODIUM—Per oz., $45@$50. London, £11.

RUTHENIUM—Per oz., $36@$40. Nominal. London, £9½.

SELENIUM—Per lb., $1.80@$2, depending on quantity, for black, powdered, 99.5 per cent pure. London, 7s. 8d.

SILICON—Per lb., minimum 97 per cent Si, maximum 1 per cent Fe, 15@17c.

Daily Prices of Metals

Sept.	Electrolytic Copper	Straits Tin	Lead		Zinc
	Refinery	New York	New York	St. Louis	St. Louis
4	10.525@10.775	29.70	5.50	5.35	4.30 @4.35
5	10.525@10.775	29.70	5.50	5.35	4.30 @4.35
6	10.60	29.75	5.50	5.35	4.325@4.35
8	10.60	29.80	5.50	5.35	4.30
9	10.60	29.85	5.50	5.35	4.30
10	10.525	29.90	5.50	5.35	4.25@4.30
Av'ge	10.604	29.783	5.500	5.350	4.310
11	10.525@10.775	30.05	5.50	5.35	4.25
12	10.275@10.525	29.875	5.50	5.35	4.25@4.275
13	10.275@10.525	29.875	5.50	5.35	4.25
15	10.30	29.875	5.50	5.30@5.35	4.25
16	10.275	29.95	5.50	5.35	4.25
17	10.275	29.85	5.50	5.35	4.25
Av'ge	10.383	29.913	5.500	5.346	4.252

Average prices for calender week ended September 6, 1930, are: Copper, 10.640c.; Straits tin, 29.750c.; New York lead, 5.500c.; St. Louis lead, 5.350c.; Zinc, 4.328c.; and Silver, 35.825c.

Average prices for calendar week ended September 13, 1930, are: Copper, 10.529c.; Straits tin, 29.892c.; New York lead, 5.500c.; St. Louis lead, 5.350c.; Zinc, 4.273c.; and Silver, 36.250c.

The above quotations are our appraisal of the major markets for domestic consumption based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis, as noted. All prices are in cents per pound.

Copper, lead, and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

In the trade, copper prices are quoted on a delivered basis; that is, delivered at consumer's plant. As delivery and interest charges vary with the destination, the figures shown above are net prices of refineries on the Atlantic seaboard. Delivered prices in New England average 0.225c. per pound above those quoted.

Quotations for copper are for the ordinary forms or wirebars and ingot bars. For ingots an extra 0.05c. per pound is charged; for slabs, 0.075c.; and for cakes, 0.125c. up, depending on weight. Cathodes are sold at a discount of 0.125c. per pound.

Quotations for zinc are for ordinary Prime Western brands. Zinc in New York is now quoted at 0.35c. per pound above St. Louis, this being the freight differential. The contract price for High-Grade zinc delivered in the East and Middle West is 1c. above the St. Louis price for Prime Western.

Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

Silver, Gold, and Sterling Exchange

Sept.	Sterling Exchange "Checks"	Silver		Gold London	Sept.	Sterling Exchange "Checks"	Silver		Gold London
		New York	London				New York	London	
4	4.86¼	36	16 9/16	85s00½d	11	4.86 1/16	36	16⅝	84s11⅞d
5	4.86 1/16	36⅛	16¾	85s00½d	12	4.85¾	36⅝	16⅞	85s00⅛d
6	4.85 13/16	35¾	16 9/16	.....	13	4.85 13/16	36¼	16 13/16	.....
8	4.85⅞	36⅜	16¾	85s00½d	15	4.85⅞	36¼	16 13/16	85s00½d
9	4.86 1/16	36⅛	16⅝	84s11⅞d	16	4.85⅞	36⅜	16 13/16	85s00¾d
10	4.86	36¼	16¾	84s11⅞d	17	4.85¾	36⅝	16⅞	85s00½d

Average of week ended September 10: Silver, 36.083c.; Sterling Exchange, $4.86010.

Average of week ended September 17: Silver, 36.396c.; Sterling Exchange, $4.85833.

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of silver, 999 fine. London silver quotations are in pence per troy ounce of bar silver, basis of 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command three-sixteenths cent premium.

London

Sept.	Copper Standard Spot	Copper Standard 3 M	Electrolytic	Tin Spot	Tin 3M	Lead Spot	Lead 3M	Zinc Spot	Zinc 3M
4	47¼	47⅜	50½	133	134¾	18 3/16	18 3/16	16 1/16	16½
5	46 15/16	47	50½	133¼	135	18 3/16	18 3/16	15 15/16	16 7/16
8	47⅛	47⅝	50½	133⅝	135⅜	18¼	18¼	16	16 7/16
9	47⅜	47½	50½	133⅝	135⅝	18¼	18¼	15 15/16	16⅜
10	47⅜	47 7/16	50½	133¾	135½	18 3/16	18 3/16	15 15/16	16⅜
11	47 5/16	47½	50½	134½	136⅜	18¼	18¼	16	16½
12	47 7/16	47 7/16	50½	134⅜	136½	18 3/16	18 3/16	15 15/16	16⅜
15	47	46⅞	50½	133⅞	135⅜	18 3/16	18⅛	15 15/16	16⅜
16	46½	46 5/16	49	134¼	135⅞	18 1/16	18 1/16	15 15/16	16¼
17	46⅛	46⅛	49	134	135⅜	17 13/16	17¾	15 15/16	16¼

Prices for lead and zinc are the official prices for the morning session of the London Metal Exchange; prices for copper and tin are the official closing buyers' prices. All are in pounds sterling per long ton (2,240 lb.).

TANTALUM—Per kilo, $128 for C.P. sheet. Slow.

TELLURIUM—Per lb., $2.

THALLIUM—Per lb., $12.50@$15.

TITANIUM—Per lb. in 50- to 100-lb. lots, 75 per cent, $5.

TUNGSTEN—Per lb. contained tungsten, 98 per cent, powdered, $1.55@$1.60.

Metallic Ores

Prices in tons of 2,000 lb., or in "units" of 20 lb., unless otherwise stated.

ANTIMONY ORE—No sales reported. London, per long ton unit, 3s. 6d.@4s. for 60 per cent sulphide ore.

BERYLLIUM ORE—Per unit of BeO, minimum 11 per cent BeO, $4@$5, f.o.b. mines. Per lb. BeO contained, 25c., c.i.f. European ports.

CHROME ORE—Per long ton, f.o.b. Eastern shipping points, Indian ores, $19.50 for 46@48 per cent Cr_2O_3 ore, and $24 for 50@51 per cent ore. London, £4⅛ for 48 per cent Rhodesian, and £4¼@£5¼ for Indian and New Caledonian.

IRON ORE—Per long ton, Lower Lake ports. Lake Superior ores:

Mesabi, non-bessemer, 51½ per cent iron, $4.50. Old Range, non-bessemer, $4.65.

Mesabi, bessemer, 51½ per cent iron, $4.65. Old Range, bessemer, 51½ per cent, $4.80.

Colorado, per long ton unit, f.o.b. mines, 20 to 23 per cent, 6½c. Steady.

Eastern ores, cents per unit, delivered at furnaces: Foundry and basic, 56 to 63 per cent, 10c.

Foreign ores, alongside docks Atlantic ports, cargo lots, cents per unit:

North African and Swedish, low-phosphorus, 10c.

Spanish and North African basic, 50@60 per cent, 9@9½c.

Swedish foundry or basic, 65@68 per cent, 10c.

Newfoundland foundry, 55 per cent iron, 9c.

MANGANESE ORE—Per long ton unit of Mn, c.i.f. North Atlantic ports, cargo lots, exclusive of duty: Brazilian, 46@48 per cent Mn, 25c.; Chilean, 47 per cent minimum. 30½c.; Indian, 48@50 per cent, 27@28c.; Caucasian, 52@55 per cent, 27@28c.; South African, 52@54 per cent, 27@28c., nominal. Inactive. Domestic, f.o.b. *Colorado* mines, 20 to 25 per cent, 30c. Steady.

Per ton in carload lots:

Chemical grades, powdered, coarse or fine, minimum 80 per cent MnO_2, Brazilian or Cuban, $60. Javan or Caucasian, 85 per cent minimum, $60. Domestic, 70 to 72 per cent, $60, f.o.b. mines.

MOLYBDENUM ORE—Per lb. of contained MoS_2, nominally 40@45c., delivered Pittsburgh. London, per long ton unit, nominal at 33s. for 80@85 per cent concentrate.

TANTALUM ORE—Per lb. Ta_2O_5, $1.40 for 60 per cent ore. Per lb., f.o.b. *New Mexico* mines, crude ore with mini-

mum 40 per cent Ta_2O_5, 85c.; 35 per cent, 65c.

TIN ORE—No market in United States. London, returning charge on 60 per cent Bolivian, £10 per long ton; on 70 per cent Nigerian, £5⅛.

TITANIUM ORE — Per gross ton, ilmenite, 45@52 per cent TiO_2, f.o.b. Atlantic seaboard, $10@$12, according to grade and impurities. Low-grade domestic, 32 to 35 per cent, about $7 @$8. Rutile, per lb., guaranteed minimum 94 per cent concentrate, 10c. in carload lots.

TUNGSTEN ORE—Per unit of WO_3, N. Y.: Chinese wolframite, $12.25, duty paid. Bolivian scheelite, $13, and domestic, $13@$14; both nominal. Crude low-grade ores, f.o.b. *Colorado*, $10 basis for 60 per cent WO_3.

VANADIUM ORE—Per lb. V_2O_5 contained, 27c., f.o.b. shipping point.

ZIRCON ORE—Per ton, 55 per cent ZrO_2, f.o.b. Atlantic seaboard, $40@$45 in 30-ton lots. Crude granular zircon, $70, f.o.b. Suspension Bridge, N. Y.

Non-Metallic Minerals

Prices received for non-metallic minerals vary widely and depend upon the physical and chemical characteristics of the commodity. Hence the following quotations can serve only as a general guide to the prices obtained by producers and dealers in different parts of the United States for their own product. In the last analysis the value of a particular non-metallic mineral can be ascertained only by direct negotiation between buyer and seller.

Tons of 2,000 lb. unless otherwise noted.

AMBLYGONITE — Per ton, f.o.b. mines, 8@9 per cent lithium oxide, $50@$60.

ASBESTOS—Per ton, f.o.b. Quebec mines, tax and bags included: Crude No. 1, $475@$575; crude No. 2, $325@ $375; spinning fibers, $150@$175; magnesia and compressed sheet fibers, $100@$135; various grades shingle stock, $50@$85; various grades paper stock, $35@$40; cement stock, $15@ $25; floats, $12@$15. Market weak and prices subject to shading.

Per ton c.i.f. New York: Rhodesian crude No. 1, $350; No. 2, $275.

BARIUM CARBONATE (Witherite)—Per ton, 90 per cent, 200 mesh, $47; 100 mesh, $44.

BARYTES—F.o.b. mines, bags extra:

Georgia: Barytes ore, crude, $6.50 per long ton; shipments are about half of normal.

Missouri: Per ton, water ground and floated, bleached, $23, car lots, f.o.b. works. Crude ore, minimum 93 per cent $BaSO_4$, less than 1 per cent iron, $7; 1 per cent iron and 93 per cent $BaSO_4$, $6@$6.50, f.o.b. mines.

BAUXITE—Per long ton: Domestic ore, chemical, crushed and dried, 55 to 58 per cent Al_2O_3, 1.5 to 2.5 per cent Fe_2O_3, $7@$8.25, f.o.b. *Alabama* and *Arkansas* mines. Other grades, 56 to 59 per cent Al_2O_3, 5 to 8 per cent SiO_2, $6.50@$8, f.o.b. *Arkansas* mines. Pulverized and dried, 56 to 59 per cent Al_2O_3, 8 to 12 per cent SiO_2, $12@ $12.25, f.o.b. *Arkansas* mines; abrasive grade, crushed and calcined, 78 to 84 per cent Al_2O_3, $15@$17.50, f.o.b. *Arkansas* mines.

Per metric ton, foreign, c.i.f. Atlantic ports: Dalmatian, 50 to 55 per cent Al_2O_3, 1 to 3 per cent SiO_2, $4.50@ $6.50; one dealer reports $7 for material running 52@54 per cent alumina and 1.50 per cent silica; market fair. Istrian, 54 to 57 per cent Al_2O_3, 3 to 5 per cent SiO_2, $5.50@$7; French, 56 to 59 per cent Al_2O_3, 2 to 4 per cent SiO_2, $6@$8; 56 per cent Al_2O_3, 1.50 per cent SiO_2, $7; 58 per cent Al_2O_3, 3@4 per cent SiO_2, $6.50.

BENTONITE—Per ton, f.o.b. Wyoming mines, dried and crushed, in bulk, $8; in bags, $10. F.o.b. Chicago, selected air-floated, $25. Market fair.

BORAX—Per ton, carload lots, in bags, crystals, $56; granulated, $50; powdered, $57.50; f.o.b. shipping point.

[1]CELESTITE—Per ton in carload lots, 90 per cent $SrSO_4$, finely powdered, $27.

CHINA CLAY (KAOLIN)—Per ton, f.o.b. *South Carolina* mines, crude lump, No. 1, $4.50; crushed to ¼ in., $6; pulverized, $9. Very slow.

Florida, washed and crushed, No. 1, $12.50; No. 2, $12.

Imported English, f.o.b. American ports; lump, $15@$25 in bulk.

EMERY—Per ton, f.o.b. *New York*, domestic crude ore, $10. Market normal. Other American ore, delivered to grinders, per gross ton, $15; Turkish and Naxos ore, $30@$35. F.o.b. *Pennsylvania*, in 350-lb. kegs, Turkish, Khasia, and Naxos grain emery, 6½c. per lb.; American, 3½@4c. Quiet with slow demand.

FELDSPAR—Per ton, ground: Canada, $22; New England, $21.50; Southern, $30; Trenton, $21; Western, $24.

Virginia, No. 1, 325 mesh, $18; 200 mesh, $15@$16; 160 mesh, $14; No. 1 glassmakers', $11. Market fair to good.

New Mexico: Crude clean No. 1 potash spar, $4.75; ground, $9.50.

FLUORSPAR—Per ton, f.o.b. *Kentucky* and *Illinois* mines:

Gravel, not less than 85 per cent CaF_2, and not over 5 per cent SiO_2, $18. Foundry lump, 85-5, $20. Ground, 95 to 98 per cent CaF_2, and not over 2½ per cent SiO_2, $32.50 in bulk; $36.50 in bags or barrels. *Colorado* mines, 82-5, $12.75.

FULLER'S EARTH — Per ton, f.o.b. *Colorado*, $18, various finenesses to minus 90 mesh.

F.o.b. *Georgia*, 30 to 60 mesh, $18; 15 to 30, $16.50; 200 up, $10; 100 up, $7. Good demand.

GARNET—Per ton, f.o.b. *New Hampshire* mines: crude or mill run, $45; unwashed grades, $85; washed, $125.

New York: Adirondack garnet concentrates, $85. Very poor demand.

Spanish grades, $60, c.i.f. port of entry.

GILSONITE—Per ton, carload lots, f.o.b. mines *Colorado:*

Selected grade, $33; seconds (mine run), $25.50. Market normal.

GRAPHITE—Per lb., f.o.b. *New York:* Ceylon lump, 7½@8½c.; chip, 6@7½c.; dust, 2½@4½c.; Madagascar flake, 6@8c. Market quiet with competition keen.

No. 1 flake, 8@16c.; fine ground, 5c. upward; amorphous, 3c. upward.

Crude amorphous graphite, $15@$35 per ton, according to grade.

GREENSAND—Per ton, f.o.b. cars, *New Jersey:* Screened and bagged, best grade, in carload lots, $20. No. 2 grade, $15. A new use for No. 2 grade has been found, for building greens on miniature golf courses. It holds the color, does not blow away, and makes a good playing surface.

GYPSUM—Per ton, f.o.b. mill, crushed rock, *Iowa*, $2.50; *Ohio* and *New York*, $3. Ground, *Ohio*, $4; *Iowa*, $6. Agricultural, $6@$7. Calcined $6@$9.

IRON OXIDE (See Ocher)—Per lb.: Standard Spanish red, 3@4½c.; domestic earth, 2@4½c. Increasing interest.

KAOLIN—See China Clay.

LEPIDOLITE—Per ton, $50@$60 for ordinary grades. Nominal.

LIMESTONE—Per ton, f.o.b. shipping points, depending on location, either lump or crushed, 25c.@$1.75.

Agricultural, $1 up to $6 for crushed or pulverized. Prices depend upon source, purity, fineness, and method of packing.

MAGNESITE—Per ton, f.o.b. *California* steel mill points, dead-burned, $29. Market about 60 per cent of normal. *Washington:* Dead-burned grain magnesite, $22.

MICA—Per ton, f.o.b. *New Mexico*, scrap, white, $21; off color, $18. Punch, white, for disks, per lb., 10c.; for washers, 8c. Good demand.

F.o.b. *New Hampshire*, roofing mica, $23; Christmas snow, $34; 40 mesh white, $40; 60 mesh, $48; 100 mesh, $60; 200 mesh, $75. Clean dry mixed bench and mine scrap, $13.

F.o.b. *North Carolina*, sheet mica: Punch, 4@6c.; 1½x2 in., 25@35c.; 2x2, 45@60c.; 2x3, 85c.@$1; 3x3, $1.40@$1.60; 3x4, $1.80@$2; 3x5, $2@$2.25; 4x6, $2.75@$3; 6x8, $3.50@ $3.75; 8x10, $5@$7.50. These prices apply both to No. 1 and No. 2 mica. Black-stained mica takes a discount of 10 to 25 per cent from this schedule. White North Carolina mica that was selling last year for $120 a ton, 70 mesh, is now going at $60 to $80, with practically no sales. Biotite, or black mica, is selling as low as $15 a ton, unground, with little or no sale of the finer sizes.

MINERAL BLACK—(Graphitic shale) —Per ton, 325 mesh, 75 per cent carbon, $22.50, f.o.b. *Virginia*.

MONAZITE—Per ton, minimum 6 per cent ThO_2, $60.

OCHER—Per ton, f.o.b. *Georgia* mines, $17.50 in sacks; $20 barrels; second grade, $10. Moderate demand.

Buff clay, 98 per cent through 325 mesh, $18.

F.o.b. *Virginia*, dark yellow, 300 mesh, 60 per cent ferric oxide, in jute bags, $19.50.

PHOSPHATE—Per long ton, f.a.s. or f.o.b. mines:

Florida, pebble, f.a.s., for export: 76@77 per cent, $7.15; 75 per cent, $6.40; 74@75 per cent, $6.15; 70 per cent, $4.65; 68 per cent, $4.10. Firm.

Florida, pebble, domestic: 76@77 per cent, $6.50; 74@75 per cent, $5.50; 72 per cent, $4.50; 70 per cent $4. Quiet.

Tennessee, ground, 80 per cent through 300 mesh, 33 per cent P_2O_5, $11.80 per ton, bags extra. Quiet.

POTASH—Per ton, contracts:

	Bags	Bulk
Muriate of potash, 80@85 per cent, basis 80 per cent	$37.15	$35.55
Sulphate of potash, 90@95 per cent, basis 90 per cent	48.25	46.65
Sulphate of potash-magnesia, 48@53 per cent, basis 48 per cent	27.80	26.20
Manure salt, 30 per cent	22.15	19.15
Manure salt, 20 per cent	15.65	12.65
Kainit, 14 per cent	12.70	9.70

Prices are delivered to Atlantic ports. Discounts up to 4 per cent for early shipment. Spot prices, $1.25@$1.50 per ton higher than above.

PUMICE STONE—Per lb., in barrels, powdered, 2½@4c.; selected lump, 5@7c.

PYRITES—Per long ton unit of sulphur, c.i.f. United States ports, guaranteed 48 per cent sulphur, Spanish, 13@13¾c.

[1]QUARTZ ROCK CRYSTALS—Per lb. in ton lots, colorless, clear but flawed, pieces ¼ to ½ lb. in weight, 20c. Flawless, for optical purposes, four times above price; larger crystals still higher.

SILICA—Per ton, water ground and floated, in bags, f.o.b. Illinois: 325 mesh, $16@$40 for 92 to 99½ per cent grades. Dry ground, air-floated, 325 mesh, 92@99½ per cent silica, $14@$30. Market steady. Glass sand, f.o.b. producing plant, $1.25@$5 per ton; molding sand, 50c.@$3.50; blast sand, $1.75@$6.

[1]SPODUMENE — Per ton, $50@$60, depending upon lithium content.

[1]STRONTIANITE — Per ton, lump, in carload lots, minimum 88@91 per cent $SrCO_3$, $100.

SULPHUR—Per long ton for domestic market, $18 f.o.b. Texas mines; $22 for export, Atlantic ports. Firm but dull.

TALC—Per ton, carload lots, f.o.b. works, containers included unless otherwise specified:

New Jersey: Soapstone, ground, $10@$12. Market fair.

New York: Double air-floated, short fiber, 200 mesh, $13.75; 325 mesh, $14.75. August business very fair.

Vermont: 99 per cent through 200 mesh, extra white, bulk basis, $8@$8.50; 97 to 98 per cent through 200 mesh, medium white, $7.50@$8. Packing in paper bags, $1 per ton extra. Demand against contracts about half of normal, with little prospect of early improvement.

Virginia: 200 mesh, $6.50@$8.75; 325 mesh, $8.75@$11. Quiet but improving.

TRIPOLI—Per ton, burlap bags, paper liners, minimum carload 30 tons, f.o.b. *Missouri:* Once ground through 40 mesh, rose and cream colored, $16. Double ground through 110 mesh, rose and cream, $18. Air-floated through 200 mesh, rose and cream, $27.50; mill run, $16.

[1]Price furnished by Foote Mineral Company, Philadelphia.

Rolled Metals

COPPER—Per lb., sheets, hot-rolled, 20¼c.; wire, f.o.b. mill, 12¼c.

LEAD SHEETS—Per lb., full rolled, 8¼c. clipped, 8½c.

MONEL METAL—Per lb., sheets, full finished, 42c.; rods, hot-rolled, 35c.

MUNTZ METAL—Per lb., rods, 16⅜c.; plates, 19⅜c.

NICKEL—Per lb., sheets, full finished, 52c.; rods, hot-rolled, 45c.

NICKEL SILVER—Per lb., sheets, 10 per cent, 24¾@25¼c.; 18 per cent, 28@28½c. Wire and rods, 10 per cent, 28¼c.; 15 per cent, 32c.; 18 per cent, 35½c.

PHOSPHOR BRONZE—Per lb., sheets and rods, 5 per cent tin, 31½c.; wire, 5 per cent, 32c.; 10 per cent, 37½c.

ZINC SHEETS—Per lb., 9½c., f.o.b. works; ribbon, 9c.; 7 per cent discount on orders for 18 tons or more.

Alloys

FERROCHROME—Per lb. of contained chromium, 4 to 6 per cent carbon, 66 to 70 per cent chromium, 11c., delivered, on contracts; spot, 11½c. Containing 2 per cent carbon, 67 to 72 per cent chromium, 17½c.; 0.06 per cent carbon, 28c.

FERROMANGANESE — Per gross ton furnace; domestic and foreign, 78@82 per cent, $94@$99, contracts, depending on quantity. Spiegeleisen, 19@21 per cent, $33 for spot carloads.

FERROMOLYBDENUM—Per lb. of Mo, f.o.b. shipping point, 50@60 per cent Mo, $1.15.

FERROPHOSPHORUS—Per ton, 18 per cent P, $91; electrolytic, 24 per cent, $122.50, f.o.b. *Alabama* and *Tennessee*.

FERROSILICON—Per gross ton, delivered, 50 per cent, $83.50; 75 per cent, $130; 14@16 per cent, $39, f.o.b. Niagara Falls, N. Y. Spot shipments $5@$10 per ton higher on 50 and 75 per cent grades.

FERROCARBONTITANIUM — Per ton, $160, f.o.b. producer's plant.

FERROTUNGSTEN—Per lb. of W contained, 75@80 per cent W, $1.10 f.o.b. works.

FERROVANADIUM—Per lb. of V contained, delivered, $3.15@$3.50.

SILICOMANGANESE — Per long ton, carload contracts, delivered, $135 for maximum 2½ per cent carbon; $145 for maximum 1 per cent carbon.

SILICON ZIRCONIUM—Per lb., 47@52 per cent Si, 35@40 per cent Zr, 18@21c.

ZIRCONIUM FERROSILICON—Per gross ton, 12@15 per cent Zr, 39@43 per cent Si, $103.50@$108.50.

Metallic Compounds

ARSENIOUS OXIDE (White arsenic)—Per lb., 4c., delivered, all positions. London, per long ton, £15¾ for Cornish white.

CALCIUM MOLYBDATE OR MOLYTE—Per lb. of contained Mo, 95c.

COBALT OXIDE—Per lb., black, 70@71 per cent contained Co, $2.10. London, 8s. for black; 8s. 10d. for gray.

COPPER SULPHATE (Blue Vitriol)—Per lb., in car lots, 4¼c. for either large or small crystals.

GERMANIUM DIOXIDE—Per gram, in 200- to 300-gram lots, $3.50.

SODIUM NITRATE—Per 100 lb., crude natural, in bags ex vessel, Atlantic ports, $1.99.

SODIUM SULPHATE (Salt Cake)—Per ton, bulk, f.o.b. works, $16.75@$18.

ZINC OXIDE—Per lb. in bags, in car lots: Lead-free, 6½c.; 10, 20 or 35 per cent leaded grades, 6¼c.; French red seal, in bags, 9⅜c.

ZIRCONIUM DIOXIDE—Per lb. in 100- to 500-lb. lots, 87 per cent ZrO_2, commercial, 50c.

Refractories

CHROME BRICK—Per ton, f.o.b. shipping point, $45.

FIRECLAY BRICK — Per M., first quality, $43, *Ohio, Kentucky, Central Pennsylvania;* second quality, $35@$38.

MAGNESITE — Brick, per ton, f.o.b. works, 9-in. straights, $65. Dead-burned grain, $40, f.o.b. Chester, Pa., or Baltimore.

SILICA BRICK—Per M., *Pennsylvania*, $43; *Alabama*, $50@$51; *Illinois* and *Indiana*, $52.

ZIRKITE—Per lb., powdered, 65@70 per cent ZrO_2, 3½c. Brick, straights, 80c.@$1 each.

Iron, Steel, and Coke

IRON—Per gross ton, Valley furnaces: Bessemer, $18.50; basic and No. 2 foundry, $18.

STEEL—Per gross ton, base prices, Pittsburgh, billets and slabs, $31; plates and structural shapes per 100 lb., $1.60@$1.65; soft steel bars, $1.65.

COKE—Per ton, Connellsville furnace, $2.60. Connellsville foundry, $3.50@$4.85. Byproduct coke, Ohio and Kentucky (Connellsville basis), $5.50; Buffalo and Detroit, $8@$8.50.